Journal

OF

The Royal Society

OF

Western Australia.

Vol. XIII.
1926-1927.

The Authors of Papers are alone responsible for the statements
and
the opinions expressed therein.

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1928.

THE ROYAL SOCIETY OF WESTERN AUSTRALIA.

PATRON: HIS MAJESTY THE KING.
VICE PATRON: HIS EXCELLENCY SIR WILLIAM CAMPION, K.C.M.G.

OFFICERS, 1926–7.

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Miss Enid Allum.
*Mr. R. E. Gatherer.

Librarian:
L. W. Phillips, M.Sc.

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Elected Members:
F. E. Allum, G. Spencer Compton, B.Sc., A.I.MM., C. A. Gardner, W. Catton Grasby, F.L.S., S. L. Kessell, B.Sc., A. Montgomery, M.A., F.G.S., Professor G. E. Nicholls, D.Sc., Mrs. M. A. Shelton.

* Miss Enid Allum resigned the position of Treasurer during the year and Mr. R. E. Gatherer was elected to the vacant office.

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LIST OF MEMBERS.*

As at July 1st, 1927.

HONORARY MEMBERS:

Bird, Mrs. A. M., The Old Farm, Albany, W.A.
Cooke, Prof. W. E., M.A., F.R.A.S., The Observatory, Sydney.
Dakin, Prof. W. J., D.Sc., F.L.S., F.Z.S. The University, Liverpool.
Diels, Dr. Ludwig, Director of Botanical Gardens and Museum, Berlin-Dahlem, Germany.
French, Charles, F.L.S., F.R.H.S., Government Entomologist, Melbourne.
Pritzel, Dr. E., Str.4, Han Sachs, Berlin-Lichderfelde.
Hancock, W. J., M.Inst.C.E., M.Inst.E.E., D.Sc., c/o Agent General's Office, London.

CORRESPONDING MEMBERS:

Alexander, W. B., M.A., Prickly Pear Laboratory, Sherwood, *via* Brisbane.
Cheel, Edwin, National Herbarium, Sydney.
Herbert, D. A., M.Sc., Department of Biology, University of Queensland.

ORDINARY MEMBERS:

Allen, F. B., M.A., B.Sc., The Technical School, Perth.
Allum, Miss Enid, The Royal Mint, Perth.
Allum, F. E., The Royal Mint, Perth.
Anderson, Joseph, Government Stores, West Perth.
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Bennetts, H. W., B.V.Sc., Dept. of Agriculture, Perth.
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Boultbee, G. F., Commercial Union Chambers, Perth.
Bowden, A. T., B.Sc., University, Perth.
Brearley, Major, N., D.S.O., M.C., C/o Airways Ltd., A.M.P. Chambers, Perth.
Buckeridge, Walter, F.I.O.O., F.S.M.C., D.B.O.A., 263 Murray Street, Perth.
Burbury, D. C., A.B.S.M., Royal Mint, Perth.
Calanchini, M. J., Mines Department, Perth.
Campion, W. E., Forests Department, Mundaring, W.A.
Carne, W. M., F.L.S., Department of Agriculture, Perth.
Christie, W. B., C/o Civil Service Club, Perth.
Clark, J. F.L.S., Department of Agriculture, or 54 Jewell Street, Perth.
Clarke, E. de C., M.A., The University, Perth.
Clifton, A. R. C., Department of Agriculture, Perth.
Clubb, Wallace, B.A., Education Department, Perth.
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Coombe, Sir Thomas M., Kt., Prince of Wales Chambers, Murray Street, Perth.
Cosby, C. S., 13 Longroyd Street, Mt. Lawley.
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Creeth, Miss M., 38 Wilson Street, West Perth.
Dale, Hylton B., 8 Wilson Street, Perth.
Dale, Mrs. H. B., 8 Wilson Street, Perth.
Dale, J., O.B.E., M.D., B.Sc., M.R.C.S., L.R.C.P., Public Health Department, Perth.
Davis, Ray, M.Sc., Technical School, Perth.
Doye, A. G., Parker Street, Bassendean.
Dwyer, J. J., 121 Barrack Street, Perth.
Edwards, Ernest, Whitfield Street, Bassendean.
Esson, A. G. D., M.A., Garrett Road, Bayswater.
Farquharson, R. A., M.A., M.Sc., F.G.S., Geological Department, British Somaliland.
Feldtmann, F. R., Geological Survey, Perth.
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Gardner, Charles A., Agricultural Department, Perth.
Garner, W. B., C/o F. H. Faulding & Co., Murray Street, Perth.

* Members are requested to notify the Hon. Secretary for Physical Science of any change of address.

LIST OF MEMBERS—*continued.*

ORDINARY MEMBERS—*continued.*

Gatherer, R. E., Royal Mint, Perth.
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Gray, H. J., M.B., B.S., 25 Richardson Street, West Perth.
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Holmes, H. D., Salvado Street, Cottesloe.
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Jackson, Horace B., Forrest Street, Cottesloe.
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Maitland, Mrs. A. G., "Bon Accord" Melville Place, South Perth.
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LIST OF MEMBERS—*continued.*

ORDINARY MEMBERS—*continued.*

Poole, George T., 33 Barrack Street, Perth.
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Wood, J. A., 15 Chester Street, Subiaco.
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Adams, A. B., Agricultural Adviser, Bunbury.
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Armstrong, Miss Florence, The Rectory, Victoria Park.
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Galbraith, A. R., M.Inst.C.E.I., L.R.I.B.A., A.M.I.E.A., City Engineer, Christchurch, N.Z.
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LIST OF MEMBERS—*continued.*

ASSOCIATE MEMBERS—*continued.*

Hancock, Mrs. W. J., C/o Agent General's Office, London.
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Hinckley, Miss C., 47 Forrest Avenue.
Hughes, T. R., 20 Tower Street, Leederville.
Hosking, Miss L., University, Perth.
Jackson, Miss Nina Florence, Forrest Street, Cottesloe.
Lambourne, Miss E., B.Sc., C/o Fire Station, Irwin Street.
LeMesurier, C. J. R., 39 St. George's Terrace.
LeSoeuf, Miss M., B.Sc., The Zoological Gardens, South Perth.
Lobstein, J. L., Technical School, Perth.
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Lovegrove, Mrs. F., Dumbleyung, W.A.
Neville, A. O., Department of North-West, Perth.
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Prisk, Miss Joyce, 24 Hamersley Road, Subiaco.
Prisk, Mrs. Olive, 24 Hamersley Road, Subiaco.
Quilty, J. F., District High School, Geraldton.
Richardson, K. C., 25 Charles Street, South Perth.
Ross, Mrs. A. D., B.Sc., Ventnor Avenue, West Perth.
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Shelton, Miss K., 20 Kershaw Street, Subiaco.
Shelton, Mrs. Wm. E., C/o W. E. Shelton, Modern School, Subiaco.
Simpson, Mrs. E. S., "Carlingford," Mill Point, South Perth.
Simpson, Miss Mary, The University, Perth.
Spicer, M. P., C/o Elder Smith & Co., Ltd., Perth.
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Steedman, H., Suburban Road, Victoria Park.
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Sutton, Miss N. E., Ellesmere Road, Mt. Lawley.
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Tipping, Miss M., 79 Rookwood Street, Mt. Lawley.
Tothill, Miss, 62 Ord Street, West Perth.
Wellwood, Miss M., 32 Mount Street, Perth.
Williams, F. A., B.Sc., Royal Mint, Perth.
Wood, W. E., Inspecting Engineer's Office, Railway Department, Perth.
Wright, A. R. L., L.R.I.B.A., Public Works Department, Perth.

STUDENT MEMBER.

Parr, Miss Marjorie.

Proceedings
of
The Royal Society of Western Australia.

Session 1926-27.

ANNUAL REPORT OF THE COUNCIL
FOR
THE YEAR ENDING 30th JUNE, 1927.

LADIES AND GENTLEMEN,

Your Council begs to submit the following report for the year ending 30th June, 1927.

MEMBERSHIP.

As from 1st July, there are 232 members on the roll, of whom seven are honorary members, four corresponding members, 154 ordinary members, 66 associate members, and one student member.

During the year seven ordinary members and three associate members have been elected, while six ordinary members and five associates have resigned. One ordinary and two associate members have been removed from the list of members on account of non-payment of subscription in accordance with Rule 12. The Council regrets to record the deaths of Mr. C. Hedley, corresponding member, and Messrs. H. Akroyd Stewart, W. Stevens, and R. T. Robinson, ordinary members.

The number of members and associate members for every year since the foundation of the society is as follows (with the exception of the year 1921 for which no list of members was published in the Journal):—

Year	1914	1915	1916	1917	1918	1919	1920	1922	1923	1924	1925	1926	1927
Members ...	...	47	59	64	64	76	75	76	89	172	161	157	154
Associates ...	...	29	19	20	19	24	27	31	40	63	72	74	66
Total	112	76	78	84	83	100	102	107	129	235	233	231	220

COUNCIL.

Thirteen meetings of Council were held during the year, the attendance of members being as follows:—

A. Gibb Maitland ...	11	A. A. Orton ...	12	C. A. Gardner ...	9
W. M. Carne ...	13	R. E. Gatherer (appointed Sept.) ...	11	C. Grasby ...	8
R. D. Thompson ...	7	L. W. Phillips ...	6	S. L. Kessell ...	3
A. D. Ross	1	L. Glauert	9	A. Montgomery ...	7
W. E. Shelton ...	11	F. E. Allum ...	11	G. E. Nicholls ...	1
		G. S. Compton ...	8	Mrs. Shelton ...	11

In September Miss Enid Allum found it necessary to resign the position of Treasurer on account of ill-health. The Council placed on record its appreciation of the work of Miss Allum and appointed Mr. R. E. Gatherer to the vacant office.

VISIT OF THE DUKE OF YORK.

An address of welcome was presented to their Royal Highnesses the Duke and Duchess of York in May last; the President and Vice-Presidents acting in this regard on behalf of the Society. In the course of a general reply to the various addresses, His Royal Highness made special reference to the terms of that presented by the Royal Society by stating that he was "most keenly interested in the application of scientific research and knowledge to industry, and wished all success to those societies which were seeking to promote the agricultural and commercial development of the State."

DELEGATES TO MEETINGS OF SCIENTIFIC ASSOCIATIONS.

The President, Mr. Allum, and Mr. Catton Grasby represented the Society as delegates at the meeting of the A.A.A.S. held in Perth in August last, while Mr. H. E. Pearson of the Perth Modern School represented the Society at the Sixth Congress of Industrial Chemistry held in Brussels.

FINANCES.

The grant received from the Treasury during the year was at the rate of £100 per annum, as compared with £75 for 1925-6, and the Council wishes to express its thanks to the Government for their increased subsidy. The large size and consequent increased cost of Volume XII. was, however, a heavy drain on the funds of the Society, the cost being twice that of any previous volume. On the other hand, and as a result of the expenditure incurred in this direction, the contents cover a variety of subjects and make valuable contributions to knowledge, much of which is of more than merely local interest and importance.

The present expenditure is only just met by the annual subscriptions together with the Government grant, and more than 75 per cent. of this expenditure is for publication purposes. In view of the increased number of papers of real scientific value now coming forward and which it is highly desirable that the Society should publish, the Council feels that if the Government could see its way to further increase their grant, the increase could be spent to advantage in the same direction. Unless it is possible to publish the results of scientific researches there will naturally be little inducement to submit papers to the Society.

PUBLICATIONS.

Volume XII., the most comprehensive of the Society's publications, has been completed at a cost of £300. The volume contains 20 papers, 29 plates and many other illustrations, together with the presidential address, reports and miscellaneous information. Volume XIII., containing the papers read before the Society during the year 1926-7, is at present in course of preparation for printing and should be available by about September next.

In September last the Council appointed a sub-committee to consider the mode of procedure to be adopted in publishing the papers read before the Society, and as a result of its report the Council resolved that:—

(i.) In future the printing and issue of the separate papers of the Journal be carried out in four quarterly parts.

(ii.) At the beginning of each year the Treasurer estimates the probable amount which will be available during the year for the Journal, and the Council fix a maximum for each quarterly part.

(iii.) The publications committee submit to the Council an estimate of the cost of each quarterly issue, and no order for printing or engraving be sent out until the authority of the Council has been communicated to the publication committee.

(iv.) The publication committee be instructed to revert to the practice of setting a limit to the amount to be spent on illustrations.

LIBRARY.

The Hon. Librarians report as follows:—

1. *Donations to the Library.*—The librarians wish to acknowledge the receipt of the gift of 62 volumes of the publications of the U.S.A. Geological Survey to the Society from the President, as well as a copy of "The Voyage of the Novara" in two volumes. The donation represents a valuable addition to the library.

2. *Exchange List.*—Nine additions in the exchange list were made during the year. The following table gives the countries, type of organisation, etc., to which the Journal is forwarded free in exchange for the Journal of the Society:—

ANALYSIS OF EXCHANGE LIST.

Country.	Scientific Societies.	Government Departments	Universities.	Museums, Libraries, etc.	Total.
Australia	9	12	4	13	38
England	3	1	1	5	10
South Africa	2	...	...	3	5
India	1	2	...	1	4
New Zealand	...	...	1	1	2
Canada	1	1	...	...	2
Europe	5	1	6	8	20
United States	2	1	10	11	24
South America ...	2	1	...	...	3
Java	...	1	...	...	1
	25	20	22	42	109

3. *New Shelving.*—The Council has made available the sum of £5 for expenditure on new shelving.

No money has been devoted to binding this year. It is hoped that the finances of the Society will permit of at least £50 being expended in this direction during the forthcoming financial year.

A catalogue of the library is still an urgent requirement, and it is to be hoped that some means will be found of making the very valuable material in the library more readily accessible to students and research workers.

REPORTS OF COMMITTEES.

Reports are attached of—

(i.) The Flora and Fauna Reserves Committee.

(ii.) The Salinity in Soils Committee.

A. GIBB MAITLAND,
President.

W. E. SHELTON,
A. A. ORTON,
Hon. Secretaries.

STATEMENT OF RECEIPTS AND EXPENDITURE FOR THE YEAR ENDED 30TH JUNE, 1927.

RECEIPTS.

	£ s. d.	£ s. d.	£ s. d.
Balance in hand on 1st July, 1926—			
In Bank—Medal Fund ...	3 16 9		
General Fund ...	69 14 10		
		73 11 7	
In Cash		2 4 7	
			75 16 2
Subscriptions—			
1924–25	2 12 6		
1925–26	22 6 3		
1926–27	153 10 0		
1927–28	2 2 0		
			180 10 9
W.A. Government Grant—July, 1926–May, 1927 ...			91 13 4
Receipts for Journal and Reprints			19 14 5
Interest on Bank Account			1 18 6
Sundries			0 1 3
NOTE.—Amounts outstanding on 30th June, 1927, are £29 2s. 6d. due to the Society for Reprints, and approximately £25 due by the Society for Printing.			
			£369 14 5

EXPENDITURE.

	£ s. d.	£ s. d.	£ s. d.
Publication of Vol. XII., Royal Society Journal—			
Diagrams, etc.		27 0 7	
Letter-press		196 10 0	
			223 10 7
Expenses Annual Meeting, 1926		...	14 14 9
Stationery and Circulars		...	7 18 6
Museum Fees		...	13 2 0
Rent on G.P.O. Letterbox L906		...	3 6 6
Petty Expenses		...	17 18 6
Balance in hand on 30th June, 1927—			
In Bank—Medal Fund...	3 16 9		
General Fund	83 18 5		
		87 15 2	
In Cash		1 8 5	
			89 3 7
			£369 14 5

Examined and found correct.

F. B. CREETH,
HYLTON B. DALE, } Hon. Auditors.
5th July, 1927.

R. E. GATHERER,
Hon. Treasnrer.

(i.) REPORT OF "SALINITY IN SOILS" COMMITTEE TO 30th JUNE, 1927.

By M. E. WOOD, Convener.

During the past 12 months the principal effort of the Committee has been directed towards obtaining a new and better set of data covering the chlorine content of rain in Western Australia than in the previous year which, owing to the exceptionally dry winter season was recognised as not being a representative one.

Still working in collaboration with the Commonwealth Meteorological Department a further 12 months' data was collected; and when the last few analyses—which are still outstanding—are to hand a start will be made to tabulate the same prior to an investigation of the important features.

Under date of 22nd March last Mr. Hunt, Commonwealth Meteorologist, wrote me as follows:—

"Dear Sir,

"After consultation with the Director of the Commonwealth Health Department, who arranged for the analyses of rain water in the Eastern States, I have decided to terminate, at least temporarily, the survey of the chlorine contents of rain water.

"Some time will elapse before the data are all to hand and can be tabulated. Subsequently, I shall have the figures examined for correlation with weather phenomena, treating the continent as a whole, at this Bureau where the meteorological information is available. For an intensive study of your own State, I should suggest that your Committee examine your own figures in the light of any weather data Mr. Curlewis might be able to supply. For this purpose I think the daily weather map and weather bulletin will provide the necessary information and I shall ask our Mr. Curlewis to make a file of these documents accessible to your investigators."

(Signed) W. E. WOOD,
Convener.

(ii.) REPORT OF THE COMMITTEE FOR PRESERVATION OF FLORA AND FAUNA RESERVES.

The Committee consists of the President (Mr. A. Gibb Maitland), and Messrs, Carne, Glauert, Catton Grasby, and the Hon. Secretary for Natural Scienee.

Several meetings were held during the 1926-1927 session, and the following matters were dealt with:—

1. Re-dedication of South Perth Reserve, No. 5574.

   When this matter again came under the consideration of Parliament the Royal Society renewed its offer of assistanee should it be decided to set aside further lands for the purpose of establishing Botanieal Gardens. A reply from the Chief Secretary intimated that the matter came under the jurisdiction of the Minister for Lands and that the proffered assistance had been placed at the disposal of the Department of Lands.

2. National Park, Swan View, No. A. 7537.

   Acting on reports that flower piekers were damaging native plants, requests were forwarded to the Commissioner of Railways and the Greenmount Road Board, asking that suitable warnings be displayed in prominent positions.

3. General.

   Information has been compiled relating to the names, boundaries, areas, descriptions and purposes of dedieation of the Reserves of Western Australia.

(Sgd.) WM. E. SHELTON,
Joint Hon. Secretary.

29th June, 1927.

EXHIBITS DURING THE SESSION 1926-27.

(Only those exhibits are noted of which details have been furnished by the member making the exhibit.)

April 12: Mr. Geo. L. Sutton.

A sample of the current F.A.Q. standard of wheat was exhibited by Mr. Geo. L. Sutton (Director of Agriculture) at a meeting of the Royal Society held on 12th April, 1927. The exhibitor stated:—"This standard contains 96·87 per cent. of millable grain, and 3·13 per cent. of foreign matter, and in this respect differs from the standard of the previous year which contained 97·13 per cent. millable grain and 2·87 per cent. foreign matter. The bushel weight of the current sample is 62¼ lbs., and this is ¼lb. less than the bushel weight of the previous year. The standard has been fixed by the joint Grain Committee of the Perth and Fremantle Chambers of Commerce, who with great trouble and at considerable expense have collected samples throughout the State in order to obtain grain fully representative of the season's harvest, and which represents the "fair average quality" of the crop. Other than that available from a visual examination of a sample representing the standard, the only definite information supplied in connection with the standard is the natural weight of the "Imperial" bushel. This is obtained with meticulous care, and presumably for the guidance of buyers overseas to whom samples of the standard wheat are sent. The irony of the position is that the buyers in Great Britain, when adjudicating upon disputed sales, absolutely ignore the bushel weight of the standard which is taken with such care. I regard the present method of selling according to a yearly variable standard as obsolete, and advocate the fixing of permanent standards whereby the bushel weight of the particular standard will be supplemented by such other details regarding the different component parts which are important from a milling standpoint, and which will be useful to overseas buyers. It is difficult to understand why such permanent standards as are used in America and Canada should not be welcomed, for both the seller and the buyer would be equally well informed as to the quality and condition of the grain which is the subject of negotiation with buyer and seller separated by long distances. The best interest of Australian grain growers demands an early recognition on the part of the merchants, and particularly of the growers, of the necessity of recognising the advantages of such a definite and more up-to-date system.

AUTHORS OF ADDRESSES AND ORIGINAL PAPERS DELIVERED DURING THE 1926-1927 SESSION.

BENNETS, H. W.—The Helminths of Western Australia.

BOWDEN, A. T.—The Story of the Forth Bridge.

GARDNER, C. A.—Contribution No. 6 to the Flora of Western Australia.

GRAY, H. R.—Western Australian Sandalwood.

MAITLAND, A. GIBB.—The Volcanic History of Western Australia. (Presidential Address.)

MAIDEN, J. H., and BLAKELY, F. W.—Fifty New Species, and Six New Varieties of Acacias. (Communicated by Mr. W. M. Carne.)

ROSS, A. D.—(1) The Evolution of the New Star Nova Pictoris.
(2) Some Physical Properties of Manganese Steels.

SIMPSON, E. S.—Contributions to the Mineralogy of Western Australia.

WOOD, W. E.—The Work of the Magnetic Observatory at Watheroo.

WRIGHT, J. G.—Canadian Wild Flowers.

JOURNAL
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Vol. XIII.

1.—DESCRIPTIONS OF FIFTY NEW SPECIES AND SIX VARIETIES OF WESTERN AND NORTHERN AUSTRALIAN ACACIAS, AND NOTES ON FOUR OTHER SPECIES.

By the late J. H. Maiden, I.S.O., F.R.S., F.L.S., and W. F. Blakely, Assistant Botanist, Botanic Gardens, Sydney. (With 22 Plates.)

Communicated by W. M. Carne, F.L.S.

(Read 12th April, 1927; Published 24th October, 1927.)

PUNGENTES (PLURINERVES).

1. Acacia pulviniformis, n. sp.

Plate i.

Frutex humilis pulviniformis, ramis diffusis vel prostratis ex nodis radices agentibus; ramulis brevibus, spinescentibus; phyllodiis filiformibus, paulo scabris, pilosis, semi-teretibus, curvatis vel flexuosis 1-2 nervis, 8-10 mm. longis, ½ mm. latis; stipulis scariosis acumenato-lanceolatis, 2.5 mm. longis capitulis solitariis 4-floris, in pedunculis filiformibus, glabris; calyce cupulari, margine sinuato, fimbriato; petalis 5, liberis, glabris, latis, uninerviis; ovario glabro; legumine non viso.

A dwarf, cushion-like shrub, stems diffuse, or rooting at intervals, the short branchlets spinescent. Phyllodia filiform, almost terete, slightly scabrous, pilose, curved or flexuose, 1-2 nerved, 8-10 mm. long, about 1 mm. broad. Stipules deciduous, scarious, lanceolate, acuminate, 2½ mm. long. Peduncles filiform, glabrous, usually solitary, bearing globular heads of 4-8 glabrous flowers, supported by broadish navicular bracts with minutely fringed margins. Calyx pyriform, with a sinuolate fringed border. Petals 5, free, glabrous, broad lanceolate, with a faint central nerve, more than twice the length of the rather large calyx. Ovary glabrous. Pod not seen.

Wagin and Broome Hill, on the Swamp Yate flats, or the low-lying situations of the Wandoo forest. A cushion-like plant occurring with such species of similar habit as Leschenaultia formosa, Dodonaea humifusa and Acacia congesta, Broome Hill, flowering in September, 1923 (C. A. Gardner, No. 2009). The type.

Near *A. acuaria*, from which it is distinguished by the minutely tomentose, hispid branches and phyllodia, more frail and less rigid phyllodia, smaller flower heads, different shaped calyx, and it appears also to differ in habit.

2. **A. calcarata,** n. sp.

Plate ii.

Frutex divaricatus spinescens 2-3 feet altus; phyllodiis quadrangularibus rigide pungentibus, prominente 4-nerviis, 2-3 cm. longis, 1·5 mm. diametro; stipulis linearibus, spinescentibus, patentibus; pedunculis glabris, filiformibus, 7 mm. longis; capitulis parvis globosis 15-20 floris; calyce profunde lobato; petalis laevibus, liberis, calyce duplo longioribus; ovario glabro; legumine non viso.

A divaricate, spinescent, glabrous shrub over 2 feet high with more or less slightly striate, angular branches. Stipules linear, spinescent, spur-like, spreading almost at right angles to the base of the phyllodia. Phyllodia quadrangular, rigidly pungent, strongly 4-nerved, 2-3 cm. long, 1½ mm. broad, articulate on a thickish base; gland small, linear, almost basal. Peduncles glabrous, filiform, 7 mm. long, bearing small globular heads of 15-20, 5-merous flowers. Bracts linear, spathulate, ciliate. Calyx glabrous, deeply lobed, the lobes abruptly acute, slightly thickened towards the top. Petals smooth, at first partly united at the base, but eventually separating, broad-lanceolate, twice the length of the calyx. Ovary glabrous. Pod not seen.

Coolgardie district (Leonard C. Webster, 1902, received per British Museum). The type.

Near *A. quadrisulcata* F. v. M., in the shape of the phyllodes, but differing widely in the stipules and flowers. *A. Carneii* Maiden also has similar phyllodes, but is distinct in other characters. It has the spreading spur-like stipules of *A. Xerophila*, but not the broad phyllode of that species.

3. **A. acellerata,** n. sp.

Plate iii.

Frutex rigidus plures pedes altus; ramis plus minus striatis, angulatis minute furfuroso-tomentosis; phyllodiis rigidis, teretibus, subulatis, striatis, pungentibus, 2.5-4.5 cm. longis, 1 mm. diametro, pedunculis glabris, filiformibus, 5-7 mm. longis; capitulis parvis globosis 20-floris; floribus 5-meris; sepalis linearibus, ciliatis, petalorum latorum lævium liberorum minus dimidio aequilongis; ovario tomentoso; legumine non viso.

A rigid shrub, probably tall, with somewhat striate, angular branches, which are more or less invested with a minute, scurfy tomentum, especially when young; stipules obliterated. Phyllodia rigid, terete, subulate, finely striate, ending in a long, sharp point, usually curved or somewhat flexuose, 2.5-4.5 cm. long, about 1 mm. in diameter; gland small, like a minute puncture near the base of the phyllodia. Peduncles filiform, glabrous, 5-7 mm. long, bearing small globular heads of about 20 5-merous flowers. Bracts spathulate to spoon-shaped, ciliate. Sepals free, linear, spathulate, ciliate, thickened upwards, not half the length of the long, broad, free petals. Ovary tomentose. Pod not seen.

East from Solomon's Well, Stirling Range (Dr. A. Morrison, 28th September, 1902). The type.

Near *A. colletioides*, A. Cunn. It has the finely striate, rigid phyllodia of *A. colletioides*, but the striæ are different and the phyllodia are more flexuose, while the attachment is also different; the flowers in both species are also dissimilar. The phyllodes also resemble to some extent those of *A. subflexuosa*, but those of *A. acellerata* differ in venation; the flowers are also different.

4. **A. sulcata** R. Br., **var. hirsuta,** n. var.

Plate i.

Ramis virgatis, teretibus paulo hirsutis; surculis iunioribus valde hirsutis; phyllodiis teretibus, striatis, arcuatis, mucronatis, 10-15 mm. longis, 1 mm. latis pedunculis filiformibus, hirsutis, pilis tenuibus canis vestitis, capitulis parvis, globosis, 6-8 floris.

A small shrub, wth slightly hirsute, terete, virgate branches; young shoots hirsute. Stipules very small, scarious, ciliate, soon deciduous. Phyllodia terete, channelled, or with 6-8 prominent nerves, usually arcuate, mucronate, 10-15 mm. long, about 1 mm. in diameter; gland microscopic, basal. Peduncles solitary, or in pairs, filiform, ciliate with long, white hairs, bearing small globular heads of 6-8 5-merous flowers. Sepals linear, spathulate, ciliate. Petals free, smooth, twice the length of the sepals. Bracts capitate, ciliate. Ovary hirsute. Pod not seen.

Israelite Bay (J.P. Brookes, September, 1915). Differing from the typical form in the small phyllodes, long peduncles and in the vestiture.

5. **A. sulcata** R. Br., **var. platyphylla,** n. var.

Phyllodiis brevibus latisque, complanatis vel semi-teretibus clavatis vel paulo arcuatis, nervis prominentibus; pedunculis geminis, paulo hirsutis, pilis canis, minutis vestitis.

Phyllodia short and broad, from complanate to semi-terete, clavate, to somewhat arcuate, with prominent nerves. Peduncles in pairs, slightly hirsute with microscopic white hairs.

Israelite Bay (Miss Brookes, 1893).

Differing from the typical form in the short, broad phyllodia.

PUNGENTES (UNINERVES).

6. **A. sedifolia,** n. sp.

Plate i.

Frutex dense ramosus compactus resinosus 1-2 feet altus; ramis teretibus; phyllodiis perviridibus, teretibus, crassis, ca. longitudinis dimidium canaliculatis, in mucrone parvo, obliquo, pungente terminantibus, 2 mm. x 1 mm.; floribus sulphureis, glabris; capitulis fere sessilibus, globbosis, 12-20 floris; calyce fere ad basin in sepala 5 angusto-dentate uninervia partito; petalis liberis, angusto-lanceolatis, uninerviis, sepalorum longiusculorum longitudinem plus duplo excedentibus; ovario glabro; legumine non viso.

A small, densely branched, glabrous, resinous shrub, 1-2 feet high, branchlets terete. Phyllodia bright green, terete, thick, curved, channelled for about half its length, terminating in a small oblique, pungent point, with a rudimentary gland or hollow at the base of the mucro on the upper surface, and sometimes with another small gland at the base, 2 mm. long, 1 mm. in diameter. Flower bright yellow, in almost sessile globular heads of 12-20 5-merous glabrous flowers. Sepals adnate at the base, narrow-lanceolate, dentate, uninerved. Petals at first partly united below the middle, eventually free, narrow-lanceolate, very acute, keeled, twice the length of the rather long sepals. Bracts glabrous, somewhat clavate. Ovary glabrous. Pod not seen.

Bendering, 120 miles east of Perth. On gravelly hills among low shrubs, notably *Lasiopetalum molle,* on the fringe of Salmon Gum forest (C. A. Gardner, No. 2006, August, 1923). The type.

Near *A. Mackeyana,* from which it differs in the smaller, non-striate phyllodia, almost sessile flower heads, and different shaped flowers.

7. **A. excentrica,** n. sp.

Plate ii.

Frutex humilis densus 6-18″ altus; ramis angulatis, plus minus tomentosis; phyllodiis uninerviis, crassis, oblongo-lanceolatis, pungentibus, 10-17 mm. longis; 3 mm. latis, confertis in ramis brevibus, robustis; stipulis persistentibus, semi-spinescentibus, pilosis; pedunculis axillaribus, plerumque phyllodiis longioribus, capitulis globosis 20-30 floris; floribus 5-meris; sepalis lineari-spathulatis, petala crassiuscula libera acuta ca. dimidio aequantibus; ovario glabro; legumine non viso.

A low, dense shrub, 6 to over 18 inches high, with angular, more or less tomentose branches. Stipules persistent, pilose, almost spinescent, 2 mm. long. Phyllodia crowding the short, robust branches, uninerved, rather dry and thick, oblong-lanceolate, terminating in a short pungent point, and abruptly tapering at the base into a minute petiole, 10-17 mm. long, 3 mm. broad, the mid-rib conspicuous on both sides, excentric, and always closer to the lower margin; gland small, on the upper margin about 2 mm. from the base. Peduncles axillary, usually exceeding the phyllodia, glabrous, compressed, with a broad navicular, scarious, ciliate bract at the base. Flowers in globular heads of about 30 5-merous glabrous flowers. Sepals linear-spathulate, about half the length of the rather thick, free, acute petals. Bracts spathulate, slightly ciliate. Ovary glabrous. Pod not seen.

Israelite Bay (J. P. Brookes, September, 1915). The type.

Near *A. Xerophila* W. V. Fitz., from which it is mainly distinguished by its tomentose branches, shorter and less pungent phyllodia, smaller and weaker stipules, longer peduncles, and more numerous flowers in the head.

8. **A. inops,** n. sp.

Plate iii.

Frutex debilis diffusus in modum vitis; ramis fere teretibus, paulo striatis 12-24″ longis; phyllodiis sessilibus, plerumque deflexis, linearisubulatis, pungentibus basi paulo hastatis, uninerviis, 8-12 mm. longis, 1-1.5 mm. latis; stipulis erectis subulatis ciliatis deciduis; pedunculis glabris filiformibus 10-25 mm. longis, capitulis globosis 5-8 floris; floribus 4-meris; alabastris acutis; calyce minimo profunde lobato; petalis, liberis, laevibus, concavis, calyce triplo longioribus; ovario glabro; legumine non viso.

A very weak, scrambling, vine-like shrub with slightly striate, terete, almost glabrous branches, 12-24 inches long. Phyllodia not numerous, sessile, rather distant and usually deflexed, linear-subulate, terminating in a long, pungent point, the base more or less hastate, with a prominent gland on the upper basal lobe, and a somewhat obscure central nerve, 8-12 mm. long, 1-1.5 mm. broad at the base. Stipules erect, subulate, ciliate, deciduous, 1-1.5 mm. long. Peduncles glabrous, filiform, usually solitary, 10-25 mm. long, bearing small globular heads of 5-8 4-merous flowers; buds very acute. Calyx very small, deeply lobed and with a prominent fimbriate border.

Petals free, smooth, concave, with a faint central nerve, fully three times longer than the calyx. Braets broad, densely fringed. Ovary glabrous. Pod not seen.

Vasse-Karridale (A. Lea, October, 1898). The type.

Near *A. ingrata*, from which it differs in habit, in the filiform, flexuose branches, smaller phyllodia, longer peduncles, in the 4-merous flowers, and in the free petals.

CALAMIFORMES (PLURINERVES).

9. **A. fragilis**, n. sp.

A. tripiycha var. *tenuis* Maiden, *Journ. Roy. Soc., N.S.W.*, LIII, 178, (1919).

Plate iv.

Frutex erectus leviter virgatus, 2-8′ altus; ramulis fere teretibus, glabris; surculis iunioribus aurea-pubescentibus; stipulis scariosis, deciduis; phyllodiis filiformibus teretibus, fragilissimis, leviter sulcatis, apice uncinato, plumoso, 3-7 cm. longis circ. 1 mm. diametro; pedunculis filiformibus, glabris; capitulis globosis 25-30 floris; floribus 5-meris, turbinatis; sepalis linearibus, spathulatis, liberis, pilosis; petalis liberis, apicibus obscuris, crassis, sepalis duplo longioribus; ovario hirsuto; legumine lineari, undulato; seminibus longitudinalibus; funiculo primum filiformi, deinde in arillum clavatum lateralem incrassatum.

An erect, somewhat virgate, shrub, 2-8 feet high, with almost terete, glabrous branches. Young tips golden-pubescent, or silky-hairy. Stipules scarious, deciduous. Phyllodia filiform or nearly so, terete, very brittle when dry, somewhat deeply channelled or longitudinally wrinkled so as to appear many-nerved, terminating in a conspicuous, uncinate, plumose point, 3-7 cm. long, about 1 mm. in diameter. Gland very small, often obscure. Peduncles filiform, glabrous, usually in pairs, supporting medium-sized globular heads of 25-30, 5-merous, turbinate flowers. Sepals linear, spathulate, hairy with dark, thickened tips. Petals free, glabrous, the tips dark-coloured and somewhat inflated, acute, twice the length of the sepals. Ovary hirsute. Pod linear, undulate, stipitate, constricted between the seeds, 6-7 cm. long, 2 mm. broad. Seeds longitudinal, oblong-ovate. Funicle filiform for about a quarter of its length, then abruptly thickened into an oblique, lateral, clavate arillus.

Kellerberrin. A spreading shrub 2-4 feet high (W. V. Fitzgerald, November, 1907); Wongan Hills (Dr. A. Morrison, October, 1903); Merredin: shrub 4-8 feet high (Max Koch, Nos. 2742, 2863); Cunderdin (W. V. Fitzgerald). Small shrub, Tammin (J. H. Maiden, November, 1909). The type. Coolgardie (L. C. Webster, 1900); shrub of 3 feet, on sandhills, Camp 56, 59, 61, Victoria Desert, Elder Exploring Expedition, 1891 (R. Helms); Camp 56, 19th September, is Lat. 29° 54′ 35″; Camp 59, 22nd September, specimen No. 9; Camp 61, 25th September (Queen Victoria Spring) is Lat. 30° 25′ 38″.

Differing from *A. triptycha* in the more slender, usually shorter and brittle phyllodes, thicker pods, and in the free petals. The phyllodes of *A. triptycha* are sometimes twice as long as the phyllodes of *A. fragilis*, and they are also more fibrous, and more strongly nerved, and will not snap readily like those of *A. fragilis*.

10. **A. eremophila** W. V. Fitz., var. **variabilis**, n. var.

Plate iv.

Frutex gracilis virgatus, ramulis leviter angulatis et pruinosis; phyllodiis rigidis teretibus, rectis, tenuiter striatis, 4-9 cm. longis, 1 mm. diametro; pedunculis pruinosis, brevissimis; capitulis globosis circiter 15-floris; floribus 5-meris; calyce late turbinato, alte partito in sepala 5 obtusa, fimbrata; petalis glabris, crassis, carinatis calyce duplo longioribus; ovario pruinoso, legumine lineari, flexuoso leviter tomentoso, 4-5 cm. longo, 1½ mm. lato; funiculo brevi in arillum pileiformem super seminis basin incrassatum; seminibus ovatus, 3 mm. x 2 mm.

A small, slender, virgate shrub, with slightly angular, more or less hoary branchlets. Phyllodia terete, filiform, rigid, straight, finely striate, and somewhat hispid, terminating in a short, dark mucro, or the young phyllodia plumose at the tips, 4-9 cm. long, about 1 mm. in diameter; gland like a small resinous puncture on the lower half of the phyllodia. Peduncles very short, hoary, supporting globular heads of about 15 5-merous flowers. Calyx broadly turbinate, deeply divided into five, obtuse, slightly thickened, fimbriate sepals. Petals glabrous, thick keeled, incurved, twice the length of the calyx. Bracts spoon-shaped, ciliate. Ovary hoary. Pods linear, flexuose, slightly tomentose, much constricted between the seeds, 4-5 cm. long, 1½ mm. broad; seeds oblong-ovate, 3 mm. long, 2 mm. broad. Funicle short, expanded into a small, white, cap-shaped aril over the end of the seed.

Comet Vale (J. T. Jutson, Nos. 84, 91, 203, 208, 208a, November and December, 1916).

Differing from the typical *A. eremophila* in the longer and more spreading phyllodia, longer pedicels, and in the slightly tomentose pods.

11. **A. abrupta**, n. sp.

Plate v.

Frutex glaber resinosus, 5′ altus; ramis rubidis, flexuosis; phyllodiis teretibus vel subquadrangularibus, incurvatis, 4-nerviis, 4-7 cm. longis, 1 mm. diametro, pedunculis solitariis, filiformibus, glabris; capitulis globosis, 30-33 floris; floribus 5-meris; sepalis partim coniunctis paulo trigono-spathulatis vel apice gibbosis; petalis liberis, glabris, marginibus paulo revolutis, sepalis duplo longioribus; ovario minute scabro, legumine non viso.

A glabrous, resinous shrub about five feet high; branches reddish, flexuose. Phyllodia terete to sub-quadrangular, usually incurved, abruptly terminating in a short mucro, with a small rudimentary gland or scar at its base, faintly 4-nerved, 4-7 cm. long, about 1 mm. in diameter; gland oblong, fairly large, depressed, usually 7-10 mm. from the slightly contracted base. Peduncles solitary, filiform, glabrous, resinous like the rest of the plant, bearing moderately large globular heads of 30-33 5-merous flowers. Sepals partly united at the base, but separating when touched, somewhat triangular-spathulate, or gibbose at the top, thick. Petals free, glabrous, the edges slightly rolled back, broadly lanceolate, with a faint central nerve, fully twice the length of the sepals. Bracts spathulate glandular, scabrous. Ovary minutely scabrous. Pod not seen. The species is so named from the abrupt termination of the phyllode.

Victoria Desert, Camp 36, Elder Expedition, on sand plain, R. Helms, No. 11, August, 1891.

A very interesting species with flexuose resinous phyllodes terminating in a suppressed gland, and abruptly and obliquely mucronate. Its position seems to be near *A. rigens* and *A. viscifolia*. From the former it differs in the more flexuose branches, very faintly nerved phyllodia, larger flower-heads, longer peduncles and resinous exudation. From the latter in the longer and thicker phyllodes, venation, different shaped gland, larger flower-heads, different shaped calyx, and scabrous ovary.

12. **A. viscifolia,** n. sp.

Plate vi.

Frutex pumilus valde resinosus ramulis angulatis; phyllodiis filiformibus, teretibus, tenuissime striatis, plerumque incurvatis, in mucronem minutum obliquum angustatis, 3-4 cm. longis, minus ½ mm. diametro; glandula parva resinosa; pedunculis brevibus, solitariis racemos breves formantibus, minute aureo-hirsutis, capitulis globosis ca. 20-25 floris; petalis laevibus vix duplo calyce longioribus; ovario glabro. Legumine non viso.

A dwarf, very resinous shrub with slightly angular branchlets, branches terete. Phyllodia filiform, terete, finely striate, usually incurved, terminating in a minute oblique mucro, 3-4 cm. long, less than ½ mm. in diameter. Gland small, like a drop of resin, close to the base. Peduncles short, solitary, or forming short racemes of 3-4 heads, more or less minutely golden-hirsute towards the top, bearing small globular heads of 20-25 flowers. Sepals partly united into a broad, obconical calyx, densely ciliate at the top. Petals smooth, white, papery, scarcely twice the length of the calyx. Bracts capitate, densely golden-hirsute. Ovary glabrous. Pod not seen.

Bruce Rock (Dr. F. Stoward, No. 170, August, 1917). The type.

It is allied to *A. Bynoeana* in the slender, resinous, curved phyllodes, but quite distinct from it in the shape of the gland, and in floral characters, as well as in habit. It is distinguished from *A. abrupta* in the more filiform phyllodes and smaller flowers.

CALAMIFORMES (UNINERVES).

13. **A. Maxwelli,** n. sp.

Plate vi.

Frutex parvus, ramis iunioribus paulo hirsutis; phyllodiis glabris, teretibus vel paulo clavatis, rugosis, fragilissimis, uninerviis, 10-18 mm. longis, 1 mm. diametro; pedunculis gracilibus phyllodiis aequilongis, capitula globosa 12 florum magnorum glabrorum gerentibus; calyce lato-turbinato, sinuato; petalis 5, liberis, laevibus, crassis, concavis, calyce plus duplo longioribus; ovaria glabro; legumine non viso.

A small shrub with shortly hirsute angular branches. Stipules scarious, deciduous, or only present on the very young branchlets. Phyllodia glabrous, or the very young ones slightly hirsute with short, white hairs, cylindrical-clavate or nearly so, rugose, uninerved, the nerve channelled or depressed on both sides, very brittle, terminating in a short, smooth mucro, 10-18 mm. long, 1 mm. in diameter. Gland small, on the lower half. Peduncles slender, glabrous, solitary, as long as the phyllodes, bearing rather large globular heads of about 12 large, glabrous flowers. Calyx broadly turbinate, sinuated, minutely fringed, the lobes gibbose. Petals 5, free, thick, concave, lanceolate, more than twice the length of the calyx. Ovary glabrous. Pod not seen.

Named in honour of G. Maxwell, a collector of botanical and entomological specimens in Western Australia in the early sixties.

Fitzgerald Range (Maxwell, per Herb. Hort. Bot. Kew. Stamped Herbarium Hookerianum, 1867). The type.

Its position is near *A. uncinella* Benth., from which it can be distinguished by its shorter, thicker, channelled or uninerved phyllodia, shorter petiole, hirsute vestiture, larger flower heads, and different shaped calyx, also in the smooth ovary.

14. **A. enervia,** n. sp.

Plate viii.

Frutex graeilis, virgatus, 5-8′ altus; sureulis iunioribus pruinosis vel aureo-pubescentibus; ramulis angulatis; phyllodiis lineari-subulatis, teretibus vel compressis, sine nervis, fragilissimis, plerumque in mucronem incurvatum angustatis, 3.5-9 em. longis, eireiter 1½ mm. latis; glandula basin extremam versus minima, leviter ereeta; pedunculis axillaribus, solitariis vel geminis, filiformibus, leviter pilosis, 4-9 mm. longis; capitulis globosis circiter 25-30 floris; floribus 5-meris; sepalis liberis lineari-spathulatis; petalis liberis, glabris leviter carinatis; bracteis spathulatis, dense ciliatis; ovario glabro vel leviter pruinoso; legumine lineari, 6 em. longo, 2 mm. lato; seminibus longitudinalibus; funiculo filiformi arillum parvum pileiformem super basin seminis formante.

A slender shrub, 6-8 feet high, glabrous except the young tips, which are more or less hoary or golden-pubescent; branchlets compressed or slightly angular. Phyllodia linear-subulate, compressed or terete, nerveless and very brittle, terminating in a straight or curved point, and usually with a small raised gland near the top of the short petiole, 3-9 cm. long, a little more than 1 mm. broad. Peduncles filiform, usually solitary, up to 9 mm. long, sprinkled with very short appressed hairs, bearing globular heads of 25-30 5-merous flowers. Sepals free, linear-spathulate, ciliate at the tips. Petals free, glabrous, slightly keeled, scarcely twice the length of the sepals. Bracts shorter than the flowers, spathulate, densely ciliate. Ovary glabrous or slightly hoary. Pods linear, stipitate, undulate, up to 6 cm. long, about 2 mm. broad, the margins nerve-like. Seeds black, ovate, longitudinal. Funicle filiform for about half its length, then thickened into a small cup-shaped aril over the end of the seed.

Hines Hill (Max Koch, No. 2806, September, 1923). The type. Kunnunoppin, Avon district (F. E. Victor, 8th February, 1911); same locality (Dr. F. Stoward, Nos. 65a, 65b, January, 1917).

Near *A. uncinella,* from which it differs in the nerveless phyllodes, different shaped bracts, and to some extent in the flowers. It appears to possess the floral characters of *A. assimilis,* but is distinct from that species in the nerveless and brittle phyllodia. It is distinguished from *A. Inceae* by the same characters as the preceding, and also in the position of the very small gland.

15. **A. Inceae,** n. sp.

Plate v.

Glabra vel fere glabra; ramulis leviter angulatis; phyllodiis teretibus, subulatis, rigidis, laevibus, obscure nerviis, sine nervis, breviter petiolatis, 3.5-5 em. longis, 1 mm. diametro; pedunculis filiformibus, solitariis vel geminis; capitulis globosis 10-15 floris; floribus 5-meris; sepalis spathulatis ciliatis: petalis angustis leviter carinatis, sepalis circiter duplo longioribus; ovario laevi; legumine incognito.

Branches virgate, glabrous or nearly so. Phyllodia terete, subulate, somewhat rigid, slightly pungent-pointed, nerveless or the nerves obscure, not brittle, very shortly petiolate, 3.5-5 cm. long, about 1 mm. in diameter; gland small, usually about 2 cm. from the base. Peduncles filiform, solitary or in pairs, bearing small globular heads of 10-15, 5-merous flowers. Sepals free, linear-spathulate, ciliate at the apex. Petals free, narrow, slightly keeled, or with a faint central nerve, acute, about half the length of the sepals. Bracts capitate, ciliate. Ovary smooth. Pod not seen.

The precise locality is unknown. The specimen is one of many received from the Royal Botanic Gardens, Kew, England, and labelled "Acacia n. sp. aff. *leptoneura*, W. Australia, Coll. Dr. W. H. Ince, Comm. Miss M. B. Ince," and dated at Kew, 23rd June, 1909.

Very close to, and could easily be mistaken for *A. enervia*, but the phyllodes are hard and tough, not brittle like those of *A. enervia*, while the gland is slightly different in shape and a considerable distance from the base of the phyllodia.

UNINERVES (TRIANGULARES).

16. **A. orbifolia**, n. sp.

Plate vii.

Frutex parvus compactus; ramis teretibus, glaucis; ramulis minute furfuroso-tomentosis; phyllodiis petiolatis, crassiusculis, oblique orbicularibus vel orbiculari-cuneatis; 3-4 nerviis, marginibus sinuato-dentatis, apiculatis, 5-12 x 5-12 mm.; stipulis subulatis, membranaceis, deciduis; pedunculis plerumque solitariis, phyllodiis multo longioribus; capitulis globosis, glabris, 10-12 floris; calyce cupulari, sinuato-lobato petalorum 5 glabrorum partim coniunctorum trientem aequilongis; ovario glabro; legumine circinato, modo statu valde immaturo viso.

A small, compact shrub, with terete, glaucous branches; branchlets minutely scurfy-tomentose. Stipules subulate, membranous, fugacious, about 2 mm. long. Phyllodia petiolate, rather thick, obliquely orbicular to orbicular cuneate, with 3-4 very fine, spreading nerves, entire or sinuate-dentate, mucronate, the margins minutely ciliate, with a short, hoary tomentum, 5-12 mm. long and about as broad; gland small, marginal, a short distance from the base. Peduncles usually solitary, almost glabrous, exceeding the phyllodia 1.5-2.5 cm. long, bearing globular heads of 10-12 rather large, glabrous flowers. Calyx cupular, sinuate, smooth, about one-third the length of the 5-merous, glabrous corolla. Petals partly united, acute, slightly keeled, about three times longer than the calyx. Ovary glabrous. Pod subspiral, but only seen in a very young state.

Wongan Hills, 132 miles N.E. of Perth (Dr. A. Morrison, 3rd October, 1903). The type.

Near *A. bidentata* Benth., and the characters which separate it from that species are its broader and different shaped phyllodia, longer peduncles, much larger flowers, and different shaped calyx. *A. bidentata* appears also to be a more rigid and more persistently tomentose shrub than *A. orbifolia*.

UNINERVES (BREVIFOLIAE).

17. **A. chrysopoda,** n. sp.

Plate vi.

Frutex parvus, dense lanate-tomentosus, surculis iunioribus ramulisque dense aureo-pubescentibus; stipulis minutis, deciduis; phyllodiis linearibus, crassis, cultriformibus, pilosis vel fere glabris, uninerviis in mucronem parvum obliquum angustatis, 10-13 mm. longis, 1.5 mm. latis; pedunculis solitariis, brevibus aureo-pubescentibus; capitulis magnis, globosis, 20-30 floris; floribus 5-meris, hirsutis; sepalis lineari-spathulatis, carinatis; petalis liberis, obtusis, carinatis, dense pilosis; ovaria pruinoso. legumine non viso.

A small, densely woolly-tomentose shrub, the young tips and branchlets matted in loose, golden woolly hairs; stipules minute, deciduous. Phyllodia linear-lanceolate to cultriform, pilose, or the very old ones nearly glabrous, thick, uninerved, with obscure lateral veins, and a small oblique mucro, abruptly tapering into the base from the vicinity of the small, marginal gland, 10-13 mm. long, 1.5 mm. broad. Peduncles solitary, short and thick, sometimes exceeding the upper phyllodes, matted in golden woolly hairs, bearing large globular heads of 20-30, 5-merous hirsute flowers. Sepals linear-spathulate, keeled, about half the length of the broad, obtuse, hirsute, keeled petals. Bracts broadly spathulate, hirsute and somewhat similar to the petals. Ovary hoary; pod not seen.

Near Cape Arid (G. Maxwell, 1875). The type.

Near *A. lachnophylla,* but the phyllodes are considerably broader and the heads are much larger, and there is also a difference in floral characters.

181 **A. oblonga,** n. sp.

Plate vii.

Frutex parvis glaber; ramulis compresso-angulatis; phyllodiis erectis, crassis, rigidis, plerumque oblongis, obtusis, obscure 3-nerviis, 1.5-2.5 cm. longis, 5-7 mm. latis; pedunculis axillaribus, solitariis vel geminis, 1.5-2 cm. longis, capitulis globosis, 17-20 floris, floribus glabris, 5-meris; sepalis liberis, angustissimis, obscure uninerviis; ovario glabro, legumine non viso.

A dwarf, glabrous or somewhat glaucous, erect shrub, with terete branches; branchlets compressed-angular, but soon becoming terete. Phyllodia erect, thick and rigid, usually oblong, obtuse or minutely mucronulate, imperfectly and faintly trinerved, or only the midvein more or less distinct, 1.5-2.5 cm. long, 5-7 mm. broad; gland very small, basal. Peduncles axillary solitary or in pairs, glabrous, 1.5-2 cm. long, bearing rather large globular heads of 17-20, 5-merous glabrous flowers. Sepals very narrow, spathulate, ciliate, a little less than half the length of the petals. Petals free, broad lanceolate, very acute, faintly nerved. Bracts spathulate, ciliate, very thin and frail. Ovary glabrous, oblique. Pod not seen.

West from Wongan Hills (Dr. A. Morrison, 2nd October, 1903).

The position of this species appears to be next to *A. sericocarpa* and *A. Merrallii.* The phyllodes also slightly resemble those of *A. Graffiana* and *A. subcoerulea,* but the solitary peduncular flower-heads removes it from the latter species. It is easily distinguished from the first by its glabrous, oblong phyllodes and glabrous branches, and from the second in the shape of the phyllode and in floral characters.

19. **A. subretusa,** n. sp.

Plate viii.

Frutex glaber; ramulis acute angulatis, rubidis; phyllodiis leviter lineari-obovatis ad spathulatis, tenuibus, oblique retusis, uninerviis, 2-3 cm. longis, 3-4 mm. latis; pedunculis axillaribus, brevissimis; capitulis parvis, globosis, 7-10 floris; floribus 5-meris; sepalis linear-spathulatis, ciliatis; petalis liberis apice leviter hispidis, uninerviis, sepalis plus duplo longioribus; ovario glabro; legumine non viso.

A glabrous shrub with acutely angular, reddish, branchlets. Stipules very small, or obscure. Phyllodia somewhat linear-obovate to spathulate, thin, obliquely obtuse, and usually retuse, faintly penninerved, and with a more or less prominent, scarcely central, nerve, 2-3 cm. long, 3-4 mm. broad in the widest part. Gland marginal, small, depressed, lunate, on the lower half of the phyllode. Peduncles very short, bearing small globular heads of 7-10 5-merous flowers. Sepals linear, spathulate, pilose. Petals free, firm, slightly hispid on the tips, and with a faint central nerve, more than twice the length of the sepals. Ovary glabrous; pod not seen.

The precise locality unknown. It was collected on the Victorian Expedition, June, 1861. It is probably a Northern Territory species.

Its position is near *A. ligustrina,* from which it differs in the thin, obliquely retuse phyllodes and glabrous branches. From *A. triquetra* it is readily distinguished by the non-glaucous branchlets and different-shaped, obtuse phyllodes.

20. **A. semicircinalis,** n. sp.

Plate viii.

Frutex paulo rigidus, ramis divaricatis, leniter spinescentibus, glabris; phyllodiis, uninerviis, ellipticis vel oblique ellipticis, sessilibus, 10-15 mm. longis, 5-10 mm. latis; stipulis subulatis, hyalinis, deciduis, 2-3 mm. longis, pedunculis axillaribus, solitariis; capitulis globosis, 30-floris; floribus 5-meris; sepalis lineari-spathulatis; petalis liberis minute fimbriatis angusto-lanceolatis; ovario glabro; legumine circinato crassiusculo, carnoso.

A somewhat rigid shrub with divaricate, slightly spinescent glabrous branches; branchlets terete, striate. Phyllodia uninerved, elliptical, or obliquely elliptical, sessile, with a small, oblique, acute point; margins nerve-like, and more or less undulate; gland small, on the lower half of the upper margin, 10-15 mm. long, 5-10 mm. broad. Stipules deciduous, subulate and somewhat chaffy, 2-3 mm. long. Peduncles axillary, solitary, rather stout, glabrous, up to 12 mm. long, bearing globular heads of about 30 5-merous flowers. Sepals linear-spathulate, more than half the length of the corolla. Petals free, fringed with a white, ragged margin. Bracts spathulate to lanceolate, ciliate. Ovary glabrous. Pod circinate, glabrous, rather thick and fleshy, but not seen in a fully developed state.

Wongan Hills, 132 miles N.E. of Perth, (Dr. A. Morrison, 3rd and 7th October, 1903). The type.

It has similar phyllodes to *A. Shuttleworthi,* but is quite different in the flowers. In general appearance it resembles *A. undulifolia,* and to some extent in the phyllodes also, but the subspinescent branches readily distinguish it from the latter species.

21. **A. pallidiramosa,** n. sp.

Plate viii.

Frutex glaber, ramulis leviter angulatis, pallidis; phyllodiis oblongo-lanceolatis vel paene, crassis, uninerviis, venis secundariis obscuris in petiolum angustatis, in mucronem brevem obliquum terminantibus, 4-4.5 cm. longis, 0.5-1 cm. latis, glandula parva, marginali; floribus leguminibusque non visis; seminibus ovatis, nitentibus, pallidis ad atro-brunneis, 5-6 mm. longis, 2-3 mm. latis; funiculo breviter semel vel bis plicato, in arillum pileiformem super seminis basin sensin incrassato, areola distincta, ovato-oblonga.

A glabrous shrub, with slightly angular, pale-coloured branchlets. Phyllodia pale, oblong-lanceolate or nearly so, rather thick, uninerved, the secondary veins obscure, slightly narrowed into the short, thick petiole, and terminating in a small, oblique mucro, 4-4.5 cm. long, 0.5-1 cm. broad, gland small, marginal, inserted on the lower half of the phyllodia. Flowers and pods not seen. Seeds ovate, glossy, pale to dark brown, 5-6 mm. long, 2-3 mm. broad. Funicle with one or two short folds, finally thickened into a cap-shaped basal aril over the end of the seed. Areola distinct, ovate-oblong.

Western Australia, without definite locality or collector. It was received from Kew and labelled "*Acacia* cf. *Meissneri,* 'Mohrunga,' 'Cannsigon,' vide 15 bottle." The authorities at Kew may be able to trace the collector and locality. We are of the opinion that it is a Western Australian species, and its true position cannot be ascertained until the phyllodes and seeds are matched with flowers. The phyllodes resemble those of *A. Tysoni,* but both species differ in vestiture.

22. **A. glabriflora,** n. sp.

Plate viii.

Frutex glaber glaucus, ramis teretibus, patentibus; phyllodiis glaucis, tenuibus, lanceolatis vel ellipticis, uninerviis, 1.5-2.5 cm. longis, 5-10 mm. latis; pedunculis solitariis, axillaribus vel racemos vix confertos in axillis superioribus formantibus; capitulis globosis, 30-35 floris; floribus glabris, 5-meris; calyce libero, glabro, lineari-spathulato; bracteis spathulatis glabris; ovario glabro; legumine non viso.

A medium sized glabrous but glaucous shrub, with terete, spreading branches. Phyllodia glaucous, thin, lanceolate to elliptical, uninerved, and more or less penninerved, very shortly petiolate, usually terminating in a very small, oblique point, 1.5-2.5 cm. long, 5-10 mm. broad; gland very small, attached at the extreme base. Peduncles solitary, axillary, or forming loose, abbreviated racemes in the upper axils; flower heads globose, 30-35 in the head. Flowers 5-merous, quite glabrous. Calyx linear-spathulate. Petals narrow lanceolate, acute, incurved, nearly twice the length of the sepals. Bracts spoon-shaped, smooth. Ovary glabrous. Pod not seen.

Between the Ashburton and De Grey Rivers (Dr. E. Clement, per Herb. Hort. Bot. Kew). The type. Turtle Island (Captain Wickham, Coll. Bynoe and Stokes, Voyage of H.M.S. "Beagle," 1839-40).

Its affinity seems to be with *A. Meissneri.* There is a strong resemblance in the general aspect of both species, both are glaucous shrubs, and the inflorescence may be either in single heads or in small racemes in both. But *A. Meissneri* has coarser and more angular branches, narrower and different-shaped phyllodes, and dissimilar flowers and bracts. It is also somewhat like the non-spinescent forms of *A. Victoriae* Benth. (*A. sentis* F. v. M.).

23. **A. Merrickae,** n. sp.

Plate vii.

Frutex humilis glaucus, ramis valde scabris, angulatis; phyllodiis glaucis, ovatis vel oblique ellipticis, breviter petiolatis, oblique mucronatis, uninerviis, pedunculis plerumque solitariis, axillaribus, sed racemos breves, 1-2″ longos aliquando formantibus; capitulis globosis 40-50 floris; floribus glabris, 5-meris; sepalis liberis spathulatis, petalis liberis linearibus fere equilongis; ovario pruinoso legumine glauco breviter stipitato linearioblongo, 5-6 cm. longo, 4 mm. lato.

A dwarf glaucous shrub; branches very rough with the enlarged, persistent bases of the shortly decurrent, common petioles. Phyllodia glaucous, ovate to obliquely elliptical, uninerved, shortly petiolate, obliquely mucronate; lateral veins prominent, spreading; gland small, marginal, usually inserted on the lower half, 1-2 cm. long, 5-10 mm. broad. Peduncles usually solitary, axillary, exceeding the phyllodia, but sometimes forming short racemes owing to the suppression of the upper phyllodes, bearing rather large, globular heads of 40-50 rich yellow, 5-merous glabrous flowers. Sepals linear, spathulate, nearly as long as the very narrow, lanceolate, free petals. Bracts peltate to capitate, slightly ciliate. Ovary hoary. Pods glaucous, shortly stipitate, linear-oblong, compressed, more or less contracted between the seeds, 5-6 cm. long, but not seen in a fully mature state. Seeds black, ovate; funicle very long, compressed, except near the point of attachment, forming a double flexuose fold some distance away from the base of the seed.

Named in honour of Miss Mary Merrick, Stenographer and Librarian, Botanic Gardens, Sydney, who has rendered us valuable assistance in the preparation of this and other Acacia papers.

Nalyering Well, North Kellerberrin (C. A. Gardner, No. 1688, 24th May, 1922). The type.

Affinity with *A. Meissneri* Lehm., but differing in the rough branches, shorter and more elliptical phyllodia, larger flower heads, more numerous and different shaped flowers, and in the narrow pods.

UNINERVES (ANGUSTIFOLIAE).

24. **A. glutinosissima,** n. sp.

Plate x.

Frutex gracilis, glutinosus, 6-12′ altus; ramis fere erectis, teretibus; stipulis lineari-foliaceis, deciduis, phyllodiis erectis, glutinosissimis, linearispathulatis, mucronatis, rectis vel incurvatis, uninerviis, 5-9 cm. longis, ad 3 mm. latis; pedunculis solitariis, filiformibus, glabris; capitulis magnis, sulphureis, 30-floris; calyce turbinato in sepala 5 linearia-spathulata, patentia partito; petalis 5 liberis calyce plus dimidio longioribus; ovario glutinoso; legumine non viso.

A slender, very glutinous shrub of 6-12 feet, with erect, almost flexuose, terete branches. Bark a deep purple-brown. Stipules linear, more or less foliaceous, deciduous. Phyllodia erect, yellowish-green and very glutinous, linear-spathulate, abruptly mucronate, straight, or more often curved, gradually tapering into the short petiole, with one more or less central depressed nerve, 5-9 cm. long, 3 mm. broad at the top. Gland small, close to the petiole. Peduncles solitary, filiform, glabrous, 2-2.5 cm. long, bearing large globular, deep yellow heads of 30 5-merous flowers. Calyx turbinate, divided to a

little below the middle into 5 linear-spathulate, slightly hispid, spreading lobes. Petals 5, free, nearly twice the length of the calyx, thick, concave, acute and more or less keeled. Ovary glutinous. Pod not seen in a fully developed state, linear, subterete, and slightly channelled on both sides.

Fifteen miles N.E. of Westonia, in yellow, sandy, arid soil in thickets of *Melaleuca* and *Casuarina horrida,* with *Eucalyptus Oldfieldi* (C. A. Gardner, No. 1851, September, 1922). The type.

Its position seems to be near *A. dodonaefolia* and *A. gnidium,* both of which are glutinous shrubs with narrow phyllodes, but those of *A. glutinosissima* are different in shape and venation. The flowers and pods are also dissimilar.

25. **A. acutifolia,** n. sp.

Plate xi.

Frutex glaber, ramis acute angulatis. phyllodiis angusto-lanceolatis vel falcato-lanceolatis in mucrone tenuissimo terminantibus, 5-10 cm. longis, 5-10 mm. latis, uninerviis, nervoso-marginatis; pedunculis axillaribus solitariis; capitulis globosis 6-8 floris; floribus maiusculis glabris; calyce crasso, brevissimo, sepalis coniunctis; petalis 4-meris liberis uninerviis calyce triplo longioribus; ovario hirsuto; legumine non viso.

A small glabrous shrub with acutely angular or narrowly winged branchlets, young tips tinged a rich purple-brown. Phyllodia narrow-lanceolate or falcate-lanceolate, terminating in a very fine, slightly pubescent point, puncticulate, uninerved, with nerve-like margins, and a prominent gland on the lower half; lateral veins somewhat obscure, spreading at almost right angles to the midrib, 5-10 cm. long, 5-10 mm. broad. Peduncles axillary, solitary, bearing globular heads of 6-8 rather large glabrous flowers. Calyx thick, very short, quadrangular, gamosepalous. Petals 4, merous, free, lanceolate, with a faint central nerve, three times longer than the calyx. Ovary hirsute. Pod not seen.

Bruce Rock (Dr. F. Stoward, No. 14, December, 1916). The type.

Near *A. dodonaefolia,* from which it is readily separated by the very acute, thin, non-resinous phyllodia, and in the 4-merous flowers.

UNINERVES (RACEMOSÆ).

26. **A. subglauca,** n. sp.

Plate xiii.

Frutex glaber, gracilis, 4-10′ altus; ramulis acute angulatis vel fere compressis; phyllodiis lineari-lanceolatis, sub-glaucis, uncinatis, uninerviis, 2-4.5 cm. longis, 5-10 mm. latis, venis lateralibus prominentibus; racemis axillaribus, glabris; capitulis 3-8, globosis, 20-30 floris; floribus 5-meris; sepalis liberis, lineari-spathulatis, ciliatis, petalorum laevium carinatorum longitudinem dimidio aequantibus. ovario glabro vel paulo hirsuto; legumine lineari, inter semino incincto, 5-10 cm. longo, 4-5 mm. lato; seminibus longitudinalibus; funiculo filiformi semel plicato, plica gradatim in arillum lateralem clavatum super seminis apice incrassata.

A slender, glabrous, sub-glaucous shrub 4-10 feet high, with spreading branches. Bark rough and fibrous at the base; branchlets acutely angular, sub-glaucous. Phyllodia linear to narrow lanceolate, uncinate, uninerved,

with prominent nerve-like margins and more or less strongly penninerved, 2-4.5 cm. long, 5-10 mm. broad; gland small, depressed, causing a slight break in the margin a little below the centre. Racemes axillary, glabrous, shorter than the phyllodia, bearing 3-8 globular heads of 20-30 5-merous flowers. Sepals free, linear-spathulate, ciliate, about half the length of the smooth, keeled petals. Bracts pilose, capitate. Ovary glabrous or slightly hairy. Pod linear, undulate, much constricted between the seeds; valves coriaceous, 5-10 c.m. long, 5 mm. broad; seeds black, ovate, longitudinal. Funicle filiform, forming a double fold partly over the seed, and terminating in a lateral, clavate arillus.

Near Bendering, on Sandalwood Reserve in thickets of *Melaleuca laxiflora* and *Acacia acuminata;* flowers December and January (C. A. Gardner, No. 1870, 4th December, 1922). The type. Kellerberrin (W. V. Fitzgerald); Bruce Rock (Dr. F. Stoward, No 32): Cunderdin (W. P. Furlong, October, 1901).

Near *A. microbotrya,* from which it may be separated by the much smaller phyllodes, smaller and somewhat glaucous racemes, and relatively smaller and narrower pods.

27. **A. subglauca,** var. **angustiuscula,** n. var.

Plate xiii.

A somewhat slightly glaucous shrub, 3-5 feet high, with smooth angular branchlets. Phyllodia glabrous, linear-lanceolate, tapering into a short, transversely wrinkled petiole, and terminating in a very fine curved, pliable, more or less hooked point, uninerved, the curve central or nearly so, and somewhat conspicuously penninerved, 2.5 cm. long, 3-4 mm. broad; gland marginal, somewhat depressed, usually about the centre. Racemes axillary, glabrous, shorter than the phyllodia, bearing 5-7 small globular heads of 25-35 5-merous flowers. Sepals free, linear-spathulate, ciliate. Petals glabrous, free, thick, somewhat prominently keeled, fully twice the length of the sepals. Bracts capitate, slightly ciliate at the top only, about the length of the sepals. Ovary densely hairy. Pod not seen.

Cunderdin (W. V. Fitzgerald, November, 1903: a shrubby form); Dwellingup (Dr. F. Stoward, No. 22); Doodlakine (W. V. Fitzgerald, November, 1903); Shrub 5 feet high on sand plain near Merredin (Max Koch, No. 3007, January, 1924). The type.

Perhaps a distinct species, but the point cannot be decided in the absence of the pods. It differs from the typical form in the linear, acuminate phyllodes, slightly larger flowers, longer, and usually keeled, petals, and in the almost glabrous bracts. It bears a striking resemblance to *A. triquetra* in the phyllodes, but is readily separated from that species by the small racemose inflorescence.

28. **A. validinervia,** n. sp.

Plate xi.

Frutex robustus plus minus glaucus; phyllodiis angusto-obovatis vel lanceolato-spathulatis, obtusis vel cum mucrone parvo obliquo, coriaceis, venis prominentibus, reticulatis, 8-10 cm. longis, 1.5-2 cm. latis: racemis glabris, simplicibus, robustis, aliquando phyllodia excedentibus; capitulis 5-20, maiusculis, fere sessilibus, globosis, 50-73 floris; calyce paulo cylindraceo, 5-costato, lobis brevibus, crassis, dense ciliatis; petalis liberis, glabris, angusto-lanceolatis, calyce duplo longioribus; ovario stipitato, glabro; legumine non viso.

Branches angular but soon becoming terete. Phyllodia obovate to lanceolate, spathulate, obtuse or with a small oblique point, much contracted into the elongated petiole, coriaceous, uninerved, with strong reticulate lateral veins, and prominent marginal nerves, the lower one confluent with the petiole for some distance, 8-10 cm. long, 1.5-2 cm. broad. Gland small, petiolar or nearly so. Racemes glabrous, simple, robust, sometimes exceeding the phyllodia, with 5-20 rather large, almost sessile, globular heads of 50-73 flowers. Peduncles very short and thick. Calyx cylindrical, five-ribbed, the short, thick lobes densely ciliate, at first united, but readily separating into narrow, somewhat spathulate sepals. Petals free, glabrous, narrow-lanceolate, uninerved, incurved, scarcely twice the length of the long calyx. Bracts capitate, ciliate at the top, the stipes angular and more or less crenulate. Ovary smooth, stipitate. Pod not seen. This species is remarkable for the number of flowers in the head; three heads averaged 73 flowers per head.

Cavanagh Range (Elder Exploring Expedition, R. Helms, 27th July, 1891), labelled by Mueller and Tate *A. notabilis*, to which it is closely allied in the inflorescence, but the phyllodes are shorter, broader, and more reticulate, while the peduncles are quite glabrous, and there is a slight difference in the flowers.

29. **A. Steedmani,** n. sp.

Plate xii.

Frutex mediocriter altus semiglaucus, ramulis angulatis; ramis teretibus pruinosis; phyllodiis variis, angustis, oblongis vel oblongo-lanceolatis ad lato-obovatis, obtusis, vel obliquo-mucronatis, oblique uninerviis, marginibus nervis similibus, 5-9 cm. longis, 1-2.5 cm. latis; racemis glaucis, phyllodiis brevioribus; floribus 30-35 in capitulo; calyce lato-turbinato, hispido; petalis 5 liberis, glabris, calycis longitudinem duplo superantibus; legumine lineari, glauco, inter semino incincto, 4-5 cm. longo, 5 mm. lato; funiculo in medio semine dilatante, duplo plicato: arillo clavato seminis apice.

A medium-sized, semi-glaucous shrub, with angular, glabrous branchlets. Phyllodia narrow-oblong, lanceolate to broadly obovate, usually obtuse or obliquely mucronate, uninerved, with nerve-like margins, and distinct lateral veins, 5-9 cm. long, 1-2.5 cm. broad, bearing 3-4 somewhat conspicuous dark glossy marginal glands. Racemes glaucous, rather stout, usually shorter than the phyllodia, bearing 5-9 large, globular heads of 30-50 bright yellow flowers. Calyx broadly turbinate, the lobes thick, hispid, separating at touch. Petals 5, free, glabrous, acute, twice the length of the calyx. Bracts broad, capitate, ciliate. Ovary glabrous. Pod glaucous, linear, constricted between the seeds, 4-5 cm. long, 5 mm. broad. Seeds longitudinal, black, glossy ovate, 4 mm. long, 3 mm. broad. Funicle partly embracing the seed in a double fold, and thickened into a basal clavate arilis over the end of the seed.

Near Southern Cross (H. Steedman, August, 1922). The type.

Near *A. validinervia*, from which it differs in the smaller, less coriaceous, triglandular phyllodes, smaller racemes, and smaller flowers.

30. **A. chrysella,** n. sp.

Plate xii.

Frutex erectus, 6-8′ altus, ramulis angulatis, glabris: phyllodiis linearibus, 1-nerviis plerumque flexis vel curvatis, 4-7 cm. long, 3mm. latis; racemis gracilibus, axillaribus, paulo aureo-pubescentibus: sepalis oblongo-spathu-

latis, 1-nerviis concavis; petalis 5-meris, liberis, sepalis semel et dimidio longioribus; ovario glabro; legumine angusto, curvato, undulato, 8-11 cm. longo, 5-7 mm. lato.

A glabrous shrub 6 or more feet high; branchlets angular. Phyllodia linear, uninerved, excentric and close to the upper margin, flat, usually curved, tapering into a long curved point, and more or less bent in the vicinty of the small marginal glands, 4-7 cm. long, up to 3 mm. broad. Glands depressed when solitary, usually close to the centre of the phyllode, when more than one, situated on the upper and lower half. Racemes slender, hoary to golden pubescent, shorter than the phyllodia, consisting of 6-10 shortly pedunculate heads of about 20 5-merous, minutely golden-pubescent flowers. Sepals oblong-spathulate, concave, thick, keeled. Petals free, concave, 1½ times longer than the sepals. Bracts triangular-clavate, ciliate, golden-pubescent. Ovary glabrous. Pods stipitate, narrow, usually curved, undulate between the longitudinally placed seeds, 8-11 cm. long, 5-7 mm. broad. Seeds black, ovate, with a small depressed ovate-oblong areola, 4-5 mm. long, 3 mm. broad. Funicle almost encircling the seed in a double fold, and terminating in a thick, galeate aril over the end of the seed.

Grows on Salmon and Gimlet land (*Eucalyptus salmonophloia* and *E. salubris*) one mile from Merredin State Farm (Dr. F. Stoward, No. 83, March, 1917). The type.

Near *A. aestivatis* Pritzel, from which it differs in the smaller racemes, narrower phyllodes and narrower pod.

31. **A. hakeoides**, A. Cunn.

Israelite Bay, in flower only (J. P. Brookes, September, 1915). New for Western Australia. Common in New South Wales, Victoria and South Australia; rare in Queensland.

32. **A. semiaurea**, n. sp.

Plate vi.

Frutex mediocriter altus, surculis iunioribus minute pruinosis vel aureo-pubescentibus; ramulis angulatis, paulo pruinosis; phyllodiis lanceolatis ad spathulatis uninerviis, 3-5 cm. longis, 1-1.5 cm. latis; racemis paucos flores gerentibus; floribus 20-30 in capitulo; sepalis primum coniunctis mox in segmenta 5-6 crassa linearia seiungentibus; petalis 5-6, liberis, angustis, lanceolatis, apice breviter pilosis; ovario glabro; legumine non viso.

A medium-sized shrub ?; young shoots minutely hoary or golden pubescent. Branchlets angular, minutely hoary. Phyllodia lanceolate to spathulate, mostly acute, gradually tapering into the petiole, thinly coriaceous, with nerve-like margins, uninerved, and more or less penninerved, 3.5 cm. long, 1-1.5 cm. broad; gland marginal, on the lower half, or about 1 cm. from the base. Flower heads moderately large, either single, or in slightly hoary racemes shorter than the phyllodia. Flowers 20-30 in the head. Calyx at first somewhat turbinate, but readily separating to the base into 5-6 linear, oblong-spathulate, ciliate, thick sepals. Petals 5-6, free, linear-lanceolate, tipped with a few short hairs, and with a faint central nerve, a little more than twice the length of the elongated sepals. Bracts stipitate, deltoid, ciliate. Ovary smooth. Pod not seen.

This species was raised from seed in the Temperate House, Botanic Gardens, Kew, England, and flowering specimens were gathered on 28th May, 1879, but we have no record of its State of origin. It, however, appears to be a Western Australian species, with a somewhat close affinity to *A. Clunies-Rossiae,* an eastern species.

The inflorescence of *A. semiaurea* is usuallly disposed in single heads, especially on the upper portion of the branchlets. That of *A. Clunies-Rossiae* is always distinctly racemose, and the phyllodes of the latter are usually narrower, less rigid and not so constricted at the base, like those of *A. semiaurea.* The phyllodia are also somewhat like some forms of *A. brachybotrya,* but differ in other characters.

33. **A. bracteata,** n. sp.

Plate x.

Frutex glaber; ramulis acute angularibus; stipulis minutis; phyllodiis planis, angusto-spathulatis ad angusto-lanceolatis, obtusis, uninerviis, 7-12 cm. longis, 1 cm. latis; racemis basi bracteatis, plerumque, 3-floris. pedunculis angulatis; capitulis magnis, globosis 30-35 floris; floribus 5-meris; alabastris oblongo-ovatis ad sub-cylindraceis; sepalis linearibus, spathulatis, petalis glabris uninerviis plus dimidio longioribus; ovario glabro; legumine non viso.

A glabrous shrub with acutely angular branchlets; stipules very small, semicarnose. Phyllodia linear-spathulate, sometimes very obtuse, tapering into a very long petiole, with a prominent central nerve, and more or less conspicuously penninerved on both sides, 7-12 cm. long, up to 1 cm. broad in the middle; gland at extreme base, rather large, ovate, glossy. Racemes usually 3-branched, but sometimes the heads in the upper axils solitary, on long glabrous peduncles. Bracts at the base of the peduncles conspicuous, imbricate, striate. Heads globular, of 30-35 rather large, 5-merous flowers; buds oblong-ovate to subcylindrical. Sepals linear-spathulate, thickened at the top, at first slightly united at the base, eventually free, more than half the length of the glabrous, uninerved petals. Bracts linear, compressed, triangular at the apex. Ovary glabrous, shortly stipitate. Pod not seen.

Range unknown; probably a Western Australian species. It was cultivated at the Temperate House, Botanic Gardens, Kew, England, and flowered in June, 1879.

Its position appears to be next to *A. suaveolena* and *A. subcoerulea,* from which it differs in the more spathulate phyllodia, larger and different shaped flowers, and in the ramification of the inflorescence.

PLURINERVES (OLIGONEURAE).

34. **A. deflexa,** n. sp.

Plate ix.

Frutex humilis diffusus 6-12″ altus, ramis teretibus, dense villosis vel fere glabris; phyllodiis lanato-pubescentibus, ellipticis, concavis, mucronatis, prominente 3-nerviis, 10-15 mm. x 4-5 mm.; pedunculis dense pilosis, solitariis vel geminis phyllodiis plerumque longioribus; capitulis globosis, 10-12 floris; floribus 5-meris, pilosis; sepalis basi breviter coniunctis, angusto-spathulatis; petalis crassis, concavis, lato-lanceolatis, uninerviis; ovario pruinoso; legumine non viso.

A low, divaricate shrub, 6-12 inches high, spreading to a much greater diameter, and sometimes diffuse. Branches terete, densely villose to almost glabrous when old. Phyllodia deflexed, loosely cottony pubescent, thick, elliptical, concave, mucronulate, prominently trinerved, 10-15 mm. long, 4-5 mm. broad, the short lateral veins prominent beneath; gland marginal, very small, close to the base. Peduncles solitary or in pairs, densely hairy, usually exceeding the phyllodia, bearing globular heads of 10-12 5-merous, hairy flowers. Sepals shortly united at the base, thick, linear spathulate or somewhat clavate. Petals thick, broad lanceolate, concave, with a faint central nerve, more than twice the length of the sepals. Bracts lanceolate-acuminate, densely hairy, Ovary hoary. Pod not seen.

Bendering, 120 miles east of Perth, in arid sandy soil on open plains among other low shrubs, notably *Chamelaucium megalopetalum* and *Acacia tamminensis* (C. A. Gardner, No. 2007, August, 1923). The type.

Affinities: With *A. trineura* F.v.M. It has the trinerved phyllodia of this species, but it is much smaller. Other characters such as vestiture, floral structure and habit help to distinguish it from *A. trineura.*

With *A. nitidula* Benth. This appears to be its closest affinity, from which it may be distinguished by its tomentose, trinerved phyllodia, and different shaped flowers.

With *A. sclerophylla* Lindl. It has the short resinous phyllodes of the above species, but they differ somewhat in shape and in the venation; the flowers are also different.

35. **A. Kingiana,** n. sp.

Plate ix.

Frutex erectus tomentosus 6-8′ altus, ramis teretibus, glandulosis, viscidis; phyllodiis atro-viridibus, paulo lanatis, cuneato-spathulatis, 2-3 nerviis, 10-15 mm. longis, 3-4 latis; pedunculis solitariis, articulatis in pedunculo communi, pruinoso, resinoso; capitulis globosis 15-20 floris; calyce hirsuto profunde 5-lobato; petalis 5 laevibus coniunctis calyce semel et dimidio longioribus; ovario hirsuto; legumine non viso.

An erect, bushy, tomentose, viscid shrub, 6-8 feet high, with dense, erect, virgate, leafy branches. Phyllodia dark green, loosely woolly-tomentose, cuneate-spathulate to cultriform, straight or curved, terminating in a small oblique, or recurved mucro 2-3 nerved, with strong nerve-like margins, 10-15 mm. long, 3-4 mm. broad; gland very small, basal. Peduncles hoary, usually solitary, articulate on elongated common peduncles, and at their junction subtended by a small, glabrous, semifoliaceous, obtuse, yellowish bract, and on the opposite side by a resinous gland. Flower heads globose of 15-20 flowers. Calyx turbinate, hirsute, with short, broad lobes. Petals 5, smooth, thick, concave, uninerved, united for about half their length, 1½ times longer than the calyx. Bracts capitate, ciliate. Ovary hirsute. Pod not seen.

Named in honour of Miss Ethel King, Artist, who for some years was attached to the National Herbarium staff.

Ten miles north-east of Wagin, in gravelly soil, in Wandoo forest (C. A. Gardner, No. 2004, September, 1923). The type.

Very close to *A. deflexa* in general appearance, but differing widely in floral characters.

36. **A. Benthamii, Meissn.**

Bentham in B. Fl. II., 324, sinks this species under *A. cochlearis,* with the following comment:—"*A. Benthamii,* Meissn, in Pl. Preiss. I. 11, II., 202, is a slight variety, quite glabrous, with narrow phyllodia: *A. heteroclita*

Meissn., is nearly allied, but has much less pungent phyllodia, with the points usually recurved, and 2 or 3 prominent nerves, and is therefore placed amongst *Plurinerves Oligoneurae.*"

There is a specimen in the National Herbarium, Sydney, which was received from the British Museum, labelled *A. cochlearis* Wendl., W. Australia, Drummond, No. 139, 2nd Collection, 1844. We are of opinion that it is referable to *A. Benthamii* Meissn., and is quite distinct from *A. cochlearis*, and also from *A. heteroclita*, to which it is closely allied, and from which it differs in the glabrous, linear phyllodia, different venation, and in the shape and position of the gland.

37. **A. obtecta**, n. sp.

Plate v.

Frutex glaber, 6-8′ altus, ramulis leviter angulatis, cinereis; phyllodiis linearibus vel angusto-lanceolatis, rectis vel apice incurvatis, leviter rigidis, obscure 3-4 nerviis, 5-10 cm. longis, 4-5 mm. latis; pedunculis brevibus. fere glabris; capitulis globosis circiter 20-floris; floribus 5-meris; sepalis liberis, lineari-spathulatis, ciliatis; petalis liberas, latis, laevibus leviter obtusis, sepalis fere duplo longioribus; ovario glabro; legumine glabro, stipitato, lineari, undulato, 6-9 cm. longo, 5-8 mm. lato, seminibus ovatis, longitudinalibus; funiculo filiformi, seminis circiter, dimidium aequante.

A glabrous shrub, up to 8 feet high, with spreading branches; branchlets slightly angular, covered with a smooth, greyish-white substance. Phyllodia narrow-lanceolate; straight or recurved towards the top, thin, somewhat rigid, rather brittle, 3-4 nerved, narrowed in to the short, transversely rugose petiole, 5-10 cm. long, 4-5 mm. broad, with 1-3 small marginal glands, the lower one usually present and much larger than the others. Peduncles short, almost glabrous, bearing globular heads of about 20 5-merous flowers. Sepals free, linear-spathulate, thickened and ciliate at the apex. Petals free, broad, glabrous, somewhat obtuse, nearly twice the length of the sepals. Bracts capitate, ciliate. Ovary glabrous. Pod glabrous, stipitate, narrow oblong, undulate, with thin, nerve-like margins, 6-9 cm. long, 5-8 mm. broad. Seeds longitudinal, ovate; funicle filiform, slightly longer than half the length of the seed.

Between Kunnoppin and Mount Marshall, and also near Lake Giles (Fitzgerald Fraser, per W. C. Grasby, winter and spring, 1919). The type.

Near *A. Benthamii*, from which it is mainly distinguished in the cinerous branches, much broader and more attenuated, unequally nerved phyllodia with different shaped glands and different texture; the peduncles are also shorter than those of *A. Benthamii*, and the petals are much broader.

From *A. heteroclita* it differs in the broader phyllodia and broader pods.

PLURINERVES (MICRONEURA).

38. **A. Loderi**, Maiden.

Journ. Roy. Soc., N.S.W., LIII., 209 (1919): *Forest Flora N.S.W.*, Part XXX., Plate 114, figs. B, C, D, E, under the name of *A rigens* A. Cunn.

Now recorded for the first time for Western Australia, from the following localities—Goongarrie (J. H. Maiden, November, 1909); Comet Vale (J. T. Jutson, No. 201), both in flower only. It is a species of low rainfall regions, and hitherto known only from New South Wales and South Australia.

39. **A. pachyacra,** n. sp.

Plate xiv.

Frutex altus glaber; ramulis fere teretibus, rubidis; phyllodiis longis, angustis, 4-nerviis, fere teretibus vel paulo quadrangularibus, apiee in mucronem obtusum abrupte eurvatis, 9-13 cm. longis, 1 mm. diametro; raeemis glabris, phyllodiis brevioribus; pedunculis eapita parva globosa ea 20 flora gerentibus; floribus 5-meris; sepalis linearibus, spathulatis, ciliatis, petala linearia acuta glabra ineurvata plus dimidio aequantibus; ovario glabro; legumine non viso.

A slender, glabrous shrub, with almost terete, reddish branehlets. Phyllodia linear, almost terete, or obtusely quadrangular, 4-nerved, brittle, aeute, or abruptly recurved at the apex into a thickened eallosity which appears to be a suppressed gland or muero, 9-13 em. long, 1 mm. in diameter; gland at extreme base, rather large, with a deep, elongated orifice. Raeemes glabrous, shorter than the phyllodia, eonsisting of 5-10 rather small peduneulate heads of about 20 5-merous flowers. Sepals linear-spathulate, ciliate, more than half the length of the narrow-ineurved, aeute, glabrous petals. Bracts rather long, eapitate, to somewhat peltate, ciliate. Ovary glabrous. Pod not seen.

Near Barrow Range, Vietoria Desert, Camp 40, Elder Exploring Expedition (R. Helms, No. 10, 3rd September, 1891). The type.

The somewhat quadrangular phyllodia brings it near *A. longispinea* in the Calamiformes, but the infloreseenee is raeemose and therefore its position seems to be near *A. prelongata* in Series Plurinerves (Mieroneura). It is somewhat similar to *A. tenuior* in the shape of the phyllodia, but differs in vestiture, and in the inflorescenee. It has the reddish stems of *A. Murrayana,* but is unlike it in botanical eharaeters.

40. **A. subangularis,** n. sp.

Plate xiv.

Frutex graeilis, virgans, leviter resinosus; ramulis angulatis, striatis, leviter pruinoso-tomentosis; stipulis minutis, resinosis; phyllodiis minute pruinosis, duris, rigidis, lineari-subulatis, forma leviter trigona propter nervum medianum, validum; glandula parva basi; filis sessilibus; ealyee cupulari. sinuolato, dense piloso; petalis 5, liberis, eoriaeeis, valde earinatis, ealueis longitudinem plus duplo aequantibus; ovario hirsuto; legumine non viso.

A slender, virgate, slightly resinous shrub; branchlets angular, striate, and more or less hoary-tomentose. Stipules minute, resinous. Phyllodia linear-subulate, hard and rigid, minutely hoary, straight or eurved, with a rather prominent eentral nerve whieh gives it a bevelled appearance, and with three or four very fine longitudinal lines on each side, and thick, nerve-like margins, usually terminating in a short, slightly pungent point; gland small, almost at the extreme base, often eoneealed by the short, elose tomentum whieh is more persistent on the base of the phyllode than elsewhere; 4-6 em. long, about 2 mm. broad. Heads solitary, or in pairs, sessile or nearly so, with about 20 flowers in the head. Flowers moderately large. Calyx cupular sinuolate, minutely hairy. Petals 5, free, smooth, keeled, somewhat coriaceous, more than twice the length of the calyx. Bracts broadly spathulate, densely hairy at the top. Ovary hirsute. Pod not seen.

North-west Plantagenet, in sand (E. Pritzel, No. 689, September, 1901, labelled by Pritzel *A. lineolata* Benth.). The type. Pritzel in *Bot. Jahrb.*, XXXV., 304 (1905) under *A. lineolata* Benth., quotes Stirling district, near Cranbrook, for D. 4416 and 689. We have not seen D. 4416, and therefore we cannot say whether it is the same as No. 689.

It is very close to *A. lineolata,* and differs from it in the narrower, subangular phyllodia, which have only one basal gland, whereas the phyllodia of *A. lineolata* are flat and usually bi-glandular, one gland is not far from the base and the other is a little below the apex; the phyllodia of the latter are also more compressed and uniformly finely nerved; the calyx of *A. lineolata* is also longer, with long, obtuse lobes, and is more than half the length of the somewhat gibbose petals.

PLURINERVES (NERVOSAE).

41. **A. sclerophylla** Lindl. var. **teretiuscula,** n. var.

A small, semiviscid shrub, with slightly angular, more or less scurfy-hispid branchlets; branches terete, reddish. Stipules minute, dark brown or black. Phyllodia farinose-resinous, thick, semiterete, straight or curved, slightly canaliculate, or with three faintly depressed longitudinal nerves, ending in a short point, 2-3 cm. long, 1.5 mm. broad; gland small, close to the very short, wrinkled petiole. Peduncles usually in pairs, glabrous, shorter than the heads, bearing globular heads of 7-10 5-merous, free flowers. Sepals linear-oblong, glabrous. Petals smooth, rather broad, more than twice the length of the sepals. Ovary slightly hispid with very short hairs. Pod not seen.

Bruce Rock, Merredin district (Dr. F. Stoward, No. 171, August, 1917).

Perhaps a distinct species, but, in the absence of pods, its true position cannot be defined. Differing from *A. sclerophylla* in the almost terete, trinerved phyllodia, slightly larger heads, somewhat different sepals, and in the hispid ovary. The phyllodes appear to be more hispid, longer, narrower and more terete than those of var. *lissophylla,* J. M. Black. They are more terete than in var. *longifolia* Benth. *A. sclerophylla* Lindl. is recorded in error for Western Australia by Mueller and Tate in *Trans. Roy. Soc., S.A.,* XVI., 352 (1892). The plant referred to is another species, with affinity to *A. sclerophylla* and *A. Oswaldii.*

PLURINERVES (DIMIDIATAE).

42. **A. platycarpa** F. Muell.

Journ. Linn. Soc. III, 145, which Bentham combined with *A. sericata* A. Cunn., and which Turrill in *Kew Bull.,* p. 289, 1922, raises to specific rank, and distinguishes it from *A. sericata* by its glabrous leaves and winged pods is represented in the National Herbarium, Sydney, from the following localities:—

Northern Territory: Near Bauhinia Downs Station (G. F. Hill, No. 806, March, 1912); Port Darwin (N. Holtze); Pine and Horseshoe Creeks (E. J. Dunn, August, 1913). The latter seems to be an intermediate form between *A. platycarpa* and *A. Dunnii* Turrill.

Western Australia: An erect slender shrub of 8 feet, or a small tree of 15-20 feet, with a smooth, powdery bark on the younger portions, that of the trunk being almost rough. Phyllodia glaucous, broadly falcate, obtuse 3-5 nerved, thick, 6-9 inches long on the adult trees, or, on the young plants sometimes exceeding 20 inches in length. Flowers light yellow, in large globular heads. Kimberley district, near the source of the Calder River, Edkins Range, Mount Agnes and eastward to the Drysdale River, in open forests of *Eucalyptus miniata* and *E. tetrodonta,* in sandy soil, sometimes forming open thickets. No pods seen. (C. A. Gardner, June, 1921.) Fitzroy River, Calvert Expedition, 1896-7, with very narrow phyllodia, Goody Goody and Derby (W. V. Fitzgerald).

Queensland: Cape York (E. Daemel); 10-15 feet high, Gilbert River, Georgetown to Croydon (R. H. Cambage, No. 3913, 23rd August, 1913); Jericho (J. L. Boorman, 1913).

JULIFLORAE (TETRAMERAE).

43. **A. malloclada,** n. sp.

Plate xv.

Frutex gracilis; ramulis angulatis villosis; stipulis parvis, scariosis; phyllodiis leviter pruinosis, linearibus, lanceolatis, tenuiter 7-10 nerviis, 3-5 cm. longis, 2-4 mm. latis; spicis gracilibus, ovoideis, pedunculatis; pedunculo pruinoso; calyce cupulari, sinuato, ciliato, petalis 4, liberis, crassis, incurvatis, calyce circiter duplo longioribus; ovario hirsuto; legumine non viso.

A slender shrub, with angular, densely villose branches. Stipules small, scarious. Phyllodia linear, lanceolate, tapering into the short, thick petiole, and usually ending in a small, smooth, oblique mucro, slightly hoary throughout, with 7-10 very fine nerves, 3-5 cm. long, 2-4 mm. broad; gland at the extreme base, very small, with an oblong or oval orifice. Spikes pedunculate, slender, cylindrical, the elongated peduncle and rachis hoary. Flowers 4-merous, slightly hoary. Calyx cupular, sinuate, ciliate, with a border of soft, white hairs. Petals free, broad, concave, nearly glabrous, about twice the length of the calyx. Bracts short, concave, hoary. Ovary hirsute. Pod not seen.

North Australia (F. Mueller, No. 28, per Herb. Hort. Bot. Reg. Kew), the precise locality unknown.

Allied to *A. cochliocarpa* and *A. neurophylla* in the venation of the narrow, rigid phyllodes, but totally different in vestiture and in the flowers.

JULIFLORAE (STENOPHYLLAE).

44. **A. sessilispica,** n. sp.

Plate xvi.

Frutex gracilis, glaber; ramulis angulatis, cinereo-furfurosis; phyllodiis tereti-subulatis, rigidis, 6-13 cm. longis, 1 mm. diametro, venis tenuibus. spicis geminis, sessilibus, 2-2.5 cm. longis; floribus parvis. globosis, 5-meris in spicis dense confertis; sepalis liberis, linearibus, spathulatis, hirsutis; petalis glabris lato-lanceolatis, incurvatis, sepalis circiter duplo longioribus; ovario hirsuto; legumine lineari, incurvato inter semina incincto, 6-7 cm. longis, 2 mm. latis; seminibus ovatis, longitudinalibus; funiculo inerassato apicem versus bis vel ter plicato

A slender, glabrous shrub, with slightly angular branchlets, which are covered with a grey, scaly substance. Phyllodia terete, subulate, rigid, usually curved, with numerous very fine, parallel nerves and a small, slightly raised gland a short distance from the base, 6-13 cm. long, 1 mm. in diameter. Spikes sessile, usually in pairs, 2-2½ cm. long, closely packed with small, globular, 5-merous, free flowers. Sepals linear, spathulate, hairy. Petals glabrous, broadly lanceolate, incurved, about twice the length of the sepals. Ovary slightly hirsute. Pod linear, glabrous, curved, constricted between the seeds, 6-7 cm. long, 2 mm. broad. Seeds ovate, longitudinal; valves thin, coriaceous. Funicle white, gradually thickened upwards into two small folds, forming a cap-shaped aril over the end of the seed.

Bruce Rock (Dr. F. Stoward, No. 163 (flowers), August, 1917); Kununoppin, same collector, No. 69 (pods), January, 1917.

Closely allied to *A. multispicata*, but sharply separated from it in the long, terete, 6-8 nerved phyllodia, in the more glabrous young shoots, rachis and flowers, and in the pod.

45. A. desertorum, n. sp.

Plate xvii.

Frutex gracilis, resinosus; ramulis paulo angulatis, striatis, phyllodiis rigidis subulatis crasse striatis vel longitudinaliter sulcatis, 10-15 cm. longis circiter 1 mm. diametro; spicis ovoideis vel fere globosis, pedunculatis; floribus magnis, glabris; calyce hirsuto, minimo, cupulari, sinuolato; petalis 5, fere dimidio longitudinis connatis, laevibus, calyce ca. quadruplo longioribus; ovario paulo pruinoso; legumine non viso.

A slender, resinous, otherwise glabrous, shrub, with slightly angular, somewhat striate, reddish branchlets, the young tips hoary-tomentose. Phyllodia rigid, subulate, terete, pungent-pointed, resinous, coarsely striate or somewhat longitudinally furrowed, 10-15 cm. long, about 1 mm. in diameter, gland basal, usually on one of the broad nerves, very small and slightly protruding. Spikes ovoid to almost spherical, pedunculate, the peduncle slightly hoary, and somewhat quadrangular. Buds cylindrical. Flowers large, glabrous. Calyx hirsute, very small, cupular, with very short lobes. Petals 5, connate to about the middle, thick, smooth, about four times longer than the calyx. Ovary slightly hoary. Pod not seen.

Victoria Desert, in sand, Camp. 54, Elder Exploring Expedition (R. Helms, No. 14, 17th September, 1891). The type. Coolgardie (L. C. Webster, 1898).

It has the irregular ovoid spikes and large cylindrical buds of *A. Jutsoni*, but the phyllodes are perfectly terete and coarsely striate, and not quadrangular as in that species. It resembles *A. longiphyllodinea* in the phyllodes, but they are thinner and shorter, with a different venation; the branches are also non-glaucous. Its nearest affinity seems to be *A. Coolgardiensis*, from which it differs in the longer and thicker phyllodes, in the pedunculate spikes and different shaped flowers.

46. A. Jutsoni Maiden.

Plate xxi.

The pods of this species were not previously described. They are linear, compressed-terete, straight or curved, slightly undulate, hoary and more or less rugose, 7-9 cm. long, 3 mm. broad. Seeds longitudinal, oblong, glossy

black, 3 mm. long. Funicle for more than half its length usually folded into one or two short folds near the suture, finally forming a conspicuous, white basal aril over the end of the seed.

Southern Cross (H. Steedman, June, 1922); also in flower at the same time, and some of the spikes are reduced to globular heads.

47. **A. inophloia, n. sp.**

Plate xvi.

Frutex erectus leviter resinosus virgato-ramosis, 6-10′ altus; cortice fibroso; surculis iunioribus aureo-pubescentibus; phyllodiis filiformibus, teretibus, subulatis, resinosis, mollibus, flexibus, 6-11 cm. longis, 1 mm. diametro, pilis brevibus, sericeis vestitis; spicis sessilibus, densis, ovoideis, ad cylindraceis; floribus 5-meris, hirsutis; calyce alte lobato, petalorum firmorum, carinatorum, hirsutorum longitudinis dimidio aequante; ovario hirsuto; legumine non viso.

"Fibre-barked Wattle." An erect, virgately branched shrub of 6-10 feet, with a dense fibrous loosely-stringy bark enveloping the trunk; branchlets resinous, angular; young tips golden-pubescent, branches terete, somewhat hoary. Phyllodia filiform, terete, resinous, infested with short, silky hairs, soft, and more or less pliable, finely striate, terminating in a very fine, slightly hooked point, 6-11 cm. long, about 1 mm. in diameter; gland like a minute resinous speck, a short distance from the base. Spikes sessile, ovoid to cylindrical, 1 cm. long, dense, light-yellow, closely packed with numerous hirsute, 5-merous flowers. Bracts deltoid, stipitate, golden-pubescent. Calyx deeply 5-lobed, about half the length of the firm, keeled, hirsute petals. Ovary hirsute. Pod not seen, but, according to collector, they are pubescent.

Bendering, in arid, gravelly soil (C. A. Gardner, No. 2010, 26th August, 1923). The type.

A. inophloia has the cortical characters of *A. Fauntleroyi* and *A. oncinophylla*, but differs from both in the terete phyllode, and in the sessile spikes, very different calyx and different pod and funicle.

48. **A. Websteri, n. sp.**

Plate xv.

Frutex mediocris, leviter resinosus; ramulis angulatis, hirsutis; phyllodiis linearibus, subulatis, resinosis, minute sericeo-pilosis, prominenter trinerviis, 5-9 cm. longis, 3 mm. latis; spicis pedunculatis ovoideis; floribus 5-meris; sepalis linearibus, spathulatis, ciliatis; petalis liberis, latiusculis, leviter carinatis, sepalis plus duplo longioribus; ovarii parte superiore hirsuta; legumine lineari, coriaceo, tenuiter penninervio, 6 cm. longo, 3 mm. lato; seminibus longitudinalibus; funiculo basi filiformi, deinde in arillum incrassatum pileiformen super semen dilatato.

A slightly resinous shrub; branchlets angular, hirsute. Phyllodia resinous, silky-hairy, linear, subulate, flat, with a curved, plumose point, 5-9 cm. long, 3 mm. broad, prominently trinerved, with nerve-like margins; gland at the extreme base, somewhat obscure. Spikes pedunculate, ovoid, about 6 mm. long. Flowers 5-merous. Sepals free, linear, spathulate, ciliate at the tips. Petals free, broad, smooth, slightly keeled, the tips deflexed, twice the length of the sepals. Bracts capitate, ciliate. Ovary hirsute on

the upper half. Pod linear, glabrous, coriaceous, penninerved, 6.5 cm. long, 3 mm. broad, slightly constricted between the seeds. Seeds oblong, pale brown, longitudinal. Funicle filiform for about half its length, then abruptly thickened into a cap-shaped aril over the end of the seed.

Coolgardie (L. C. Webster). The type.

Very close to *A. oncinophylla,* but differing in the phyllodia, position, and shape of the gland, different shaped flowers, smaller spikes, and in the narrow, glabrous pods.

49. **A. Fauntleroyi,** n. sp.

(*A. oncinophylla* Lindl., var. *Fauntleroyi;* Maiden, *Journ. Roy. Soc., N.S.W.,* LIII., 214, 1920.)

Plate xviii.

Frutex altus Fibre-bark Wattle vocatus, caule tenui; cortice fibroso, ramulis angulatis, viscidis, dense pubescentibus; phyllodiis aromaticis, pilis brevibus eanis tectis, linearibus, rectis vel leviter eurvatis, 10-20 cm. longis, 3-4 mm. latis, crassis, rigidis, 7 vel pluribus nerviis; spicis plerumque geminis, pedunculatis, brevibus 1.5 cm. x 1 cm; floribus 5-meris; ealyee eylinddroideo, irregulariter lobato, pilis longis teetis; petalis hirsutis dimidio longitudinis iunctis; ovario tomentoso; legumine lineari, stipitato, 1 cm. x 5 mm.; lato, dense villoso; seminibus longitudinalibus; funiculo semel plieato in arillum earinosum incrassatum.

It is fully described in the above Journal, and on p. 216 l.e. it is eompared with *A. oncinophylla.* We now agree that it is specifieally distinct from the latter species, and do not hesitate to raise it to specifie rank.

JULIFLORAE (FALCATAE).

50. **A. Clementi,** n. sp.

Plate xix.

Frutex robustiusculis; ramulis angulatis, aureo-pubescentibus; phyllodiis villosis augusto-lanceolatis, crassis, rigidis, fere pungentibus, obscure trinerviis, 5-8 cm. longis, .5-1.5 cm. latis, spicis cylindraceis, crassiusculis, breviter pedunculatis, aureo-pubescentibus; floribus grandiusculis, calyce cupulare, dense tomentoso, sinuolato; petals 5, liberis, glabris, linearilanceolatis, leviter carinatis, calyce plus duplo longioribus; ovario oblongo-ovato, stipitato, pruinoso; legumine non viso.

A stout shrub, with hoary young branchlets, and more or less golden-pubescent. Phyllodia narrow-lanceolate to falcate-lanceolate, thick, rigid, almost pungent, minutely velvety-pubescent when young, almost glabrous when old, obscurely trinerved, or the midrib alone deseernible, 5-8 em. long, .5-1.5 cm. broad, gland very small, usually on the lower half of the phyllode. Spikes pedunculate, cylindrical, rather thick, golden-pubescent when young, the thick peduncle hoary. Flowers moderately large. Calyx cupular, densely tomentose, sinuolate. Petals 5, free, glabrous, linear-lanceolate, 1-nerved more than twice the length of the calyx. Bracts capitate, golden-pubescent. Ovary densely tomentose, on a short, thick stipes. Pod not seen.

Between the Ashburton and Yule Rivers (Dr. E. Clement, No. 225, per Herb. Hort. Bot. Reg. Kew). The type.

Near A. Cuthbertsoni, but differing in the less finely striated phyllodia, longer spikes, and in the structure of the flowers.

51. **A. eriopoda**, n. sp.

Plate xix.

Frutex gracilis; ramulis angulatis; phyllodiis tenuibus, lineari-lanceolatis, leviter resinosis, obscure tri-nerviis, tenuiter striatis, 8-12 cm. longis, 3-5 mm. latis; spicis cylindraceis, 3-4 simul, pedunculatis, 2-3 cm. longis; pedunculis gracilibus, brevibus, lanoso-tomentosis; calyce cupulare, truncato vel fere truncato, dense tomentoso; petalis 4 vel 5 dimidio longitudinis inunctis, glabris, carinatis, calyce duplo longioribus; ovario hirsuto; legumine non viso.

A slender, leafy shrub; branchlets angular. Phyllodia thin, linear-lanceolate, with a dark, slightly resinous, curved point, very faintly tri-nerved, or only the midrib more or less conspicuous, finely striate, 8-12 cm. long, 3-5 mm. broad, gland small, basal. Spikes numerous, cylindrical, usually in clusters of 3 or 4, 2-3 cm. long, pedunculate, the peduncles slender, rather short, woolly-tomentose; rachis glabrous; young spike hoary. Calyx cupular, covered in white woolly hairs. Petals 4 or 5, minutely hoary, united about half way up, with a faint central nerve, about twice the length of the calyx. Ovary hoary. Pod not seen.

Meda (Dr. H. Basedow, No. 7, April, 1916). The type.

Very closely allied to *A. doratoxylon* in the phyllodes and in the flowers but the spikes are simple and numerous, not racemose. It also resembles *A. proxima* in the phyllodes and inflorescence, but differs in the arrangement of the spikes, woolly peduncles and different shaped flowers.

52. **A. numerosa**, n. sp.

Plate xix.

Frutex glaber; ramulis angulatis, surculis junioribus resinosis; phyllodiis angusto-lanceolatis ad falcato-lanceolatis, tri-nerviis, 10-15 cm. longis, 5-7 mm. latis; spicis breviter pedunculatis, gracilibus, cylindraceis in racemis 3 vel 5, 3-4 cm. longis; floribus 5-meris; sepalis lineari-oblongis, obtusis, pilosis; petalis 5, pilosis dimidio longitudinis partitis tenuibus, chartaceis, sepalis plus duplo longioribus; ovario pruinoso; legumine lineari, semi-tereti, 5-6 cm. x 4 mm.

A glabrous shrub; branchlets angular; young tips resinous. Phyllodia narrow-lanceolate, or falcate-lanceolate, usually with a distinct incurved point, thin, trinerved, the mid-rib conspicuous on both sides, and with very fine longitudinal lines between the main nerves, 10-15 cm. long, 5-7 mm. broad, gland basal, usually raised above the margin and with a distinct round orifice. Spikes on slender, glabrous peduncles, cylindrical, often in clusters of 3 or 5, 3-4 cm. long. Flowers 5-merous. Sepals linear-oblong, obtuse, hairy, free or very shortly united at the base. Petals hairy, minutely ciliate, divided to about the middle, thin, with a faint central nerve, more than twice the length of the sepals. Ovary hoary. Pod linear, almost terete, slightly thickened upwards, and more or less constricted between the seeds; valves thin, coriaceous.

Napier Broome Bay (G. F. Hill, for A. J. Campbell, (1910).

Very close to *A. eripoda* in the phyllodia and in the arrangement of the spikes. The former character, however, is more falcate, and the latter are furnished with glabrous peduncles. The structure of the flowers and braets is also different in both species.

53. A. cognata, n. sp.

Plate xx.

Frutex altus, ramulis acute angulatis; surculis iunioribus resinosissimis; phyllodiis angusto-lanceolatis ad falcato-lanceolatis, tenuibus, coriaceis, uninerviis, lineis numerosis tenuibus, parallelis; 7-10 cm. longis, 5-8 mm. latis; spicis pedunculatis, cylindraceis, glabris, 2-3 cm. longis; calyce cupulare 5-costato, sinuolato, leviter piloso; petalis 5, liberis, glabris, lineari-lanceolatis, acutis, calyce plus duplo longioribus; ovario semi-hirsuto; legumine non viso.

A tall shrub; branchlets acutely angular; young tips very resinous. Phyllodia narrow-lanceolate, or falcate-lanceolate, usually much incurved at the top, thin, coriaceous, contracted at the base into a very short, wrinkled petiole, with one prominent nerve and striate with numerous, fine, longitudinal veins, 7-10 cm. long, 5-8 mm. broad; gland basal, microscopic. Spikes pedunculate, cylindrical, 2-3 cm. long. Calyx somewhat quinquangular or costate, sinuolate, densely hairy on the ribs. Petals 5, free, glabrous, linear-lanceolate, acute, more than twice the length of the calyx. Bracts capitate,, ciliate. Ovary with a few short, white hairs on the top, contracted at the base into a short, thick stipes. Pod not seen.

Israelite Bay (J. P. Brookes, September, 1915). The type.

Near *A. doratoxylon* in the shape of the phyllodia, but differing in texture and venation, and also in the flowers and long bracts.

54. A. adsurgens, n. sp.

Plate xx.

Frutex gracilis, glaber; ramulis compresso-angulatis, farnoso-resinosis; phyllodiis linearibus, rigidis, obscure 1-nerviis, venis tenuibus longitudinalibus utroque latere, 10-13 cm. longis, 3 mm. latis; spicis ovoideis ad breviter cylindraceis, 10-12 mm. longis, pedunculatis; calyce cupulare, truncato, costis 5 pilosis; petalis 4-5, glabris, circiter tertio longitudinis iunctis; carinatis, calyce circiter duplo longioribus. ovario glabro, resinoso.

A slender, glabrous shrub, except for a mealy-resinous substance investing the young, compressed-angular branchlets; young tips slightly resinous. Phyllodia linear, rigid, vertical, yellowish-green when dry, 10-13 cm. long, 3 mm. broad, with one slightly raised central nerve, and 3-4 almost invisible, fine longitudinal lines on each side, gland basal, rather large, ovate with a slight depression in the middle. Spikes peduncuate, ovoid to shortly cylindrical, 10-12 mm. long, the peduncles robust, more or less resinous; rachis resinous, minutely tomentose. Calyx rather large, cupular, truncate or nearly so, with faint, shortly hairy ribs, and a somewhat fringed border. Petals 4 or 5, glabrous, united about one-third up, keeled, scarcely twice the length of the calyx. Ovary glabrous: young pods very resinous, but not seen in a fully developed state.

Thirty-five miles north-east of Camp 2, G. F. Hill, No. 261, 7th June, 1911, in late flower; 40 miles west of Camp 4, Lander Creek, same collector, No. 360, 21st June, 1911, in late flower and very early fruit.

These are the specimens referred to under *A. doratoxylon* A. Cunn. aff., in the "Flora of the Northern Territory," page 343. The position of this species seems to be next to *A. resinomarginea*. The phyllodes of *A. resinomarginea* are usually trigonus, but occasionally some are flat and broad, and not unlike those of *A. adsurgens*. The spike, and also the calyx, appears to be almost the same in both species. Some of the very narrow forms of *A. doratoxylon* var. *angustifolia* are remarkably like *A. adsurgens* in general appearance, and also some specimens of *A. granitica*.

55. **A. Jibberdingensis**, n. sp.

Plate xvii.

Frutex altus, glaber; ramulis angulatis; phyllodiis compressis vel leviter triangulis, tenuibus reetis vel flexuosis, 3-4 nerviis, marginibus prominentibus nervis similibus, 11-17 cm. longis, 2mm. latis, glandulis 3 vel 5; spicis pedunculatis, cylindraceis, plerumque geminis, 2-3 cm. longis; floribus 4-meris; calyce brevissimo, lobis brevibus, crassis, hispidis; petalis latis, carinatis calyce plus triplo longioribus; ovario hirsuto; legumine lineari, inter semino incineto, 6-7 cm. longo, 5-6 mm. lato.

A tall, glabrous shrub with spreading, angular branchlets. Phyllodia linear, compressed to somewhat obscurely triangular, thin, straight or curved, ending in a short, curved plumose point. 3-4 nerved, with nerve-like margins, and 3 or 5 distant marginal glands, 11-17 em. long, 2 mm. broad. Spikes pedunculate, slender, cylindrical, 2-3 em. long, usually in pairs. Flowers 4-merous; calyx very shallow, with short, thick, slightly hispid lobes. Petals broad, keeled, glabrous, the tips reflexed, more than three times the length of the calyx. Ovary hirsute. Pod linear, compressed, much constricted between the seeds, 6-7 cm. long, 5-6 mm. broad. Seeds not seen.

Jibberding, east of the 120-mile peg, north of Cunderdin, on the East Goldfield Railway (Max Koch, No. 1339, September, 1906). The type.

Near *A. oncinophylla,* from which it differs in the narrow, somewhat angular phyllodes, more numerous glands, slender, glabrous spikes, 4-merous flowers, and different shaped pods.

56. **A. glabripes**, n. sp.

Plate xviii.

Frutex gracilis, glaber; ramulis leviter angulatis, resinosis; phyllodiis angusto-laneeolatis, leviter resinosis, crassis, obscure trinerviis, 3-4 em. longis 4-7 mm. latis; spicis ovoideis, in pedunculis longis, gracilibus, glabris; floribus glabris, magnis; ealyce eupulari, sinuolato, leviter ciliato; petalis 5, lineari-laneeolatis, erassis, carinatis calyee plus duplo longioribus; ovario glabro; legumine non viso. (Inter flumina Ashburton et Jule, W.A., Dr. E. Clement.)

A slender, glabrous shrub, with slightly angular, resinous branchlets. Phyllodia narrow-laneeolate, with a straight or hooked point, slightly resinous, somewhat thick, obscurely trinerved, 3-4 em. long, 4-7 mm. broad, gland at the extreme base, very small. Spikes ovoid to cylindrical, on very long, smooth peduncles. Flowers glabrous, rather large. Calyx broadly eupular sinuolate. Petals narrow-lanceolate, thick, prominently keeled, eoneave, and faintly trinerved towards the top, more than twice the length of the calyx. Bracts coneave, lanceolate, slightly tomentose. Ovary glabrous. Pod not seen.

Between the Ashburton and Yule Rivers (Dr. E. Clement, per Herb. Hort. Bot. Reg., Kew). The type.

Near *A. Hammondi* on the one hand and *A. leptophleba* on the other. It has also the same shaped phyllodes of *A. curvicarpa,* but they are considerably smaller. In the elongated, peduneulate spikes it resembles *A. curvinervia,* but is distinct in floral characters.

57. **A. sphaerogemma,** n. sp.

Plate xv.

Frutex gracilis, leviter glutinosus et pruinosus; ramulis angulatis; stipulis parvis, scariosis, semi-persistentibus; phyllodiis angusto-lanceolatis basi leviter villosis binerviis, lineis numerosis tenuibus parallelis inter nervos, 4-7 cm. longis, 5-8 mm. latis; spicis simplicibus vel geminis, cylindraceis, pedunculatis; calyce cupulare, sinuolato, ciliato; petalis 5, liberis glabris, crassis, calyce plus duplo longioribus; ovario glabro praeter fimbriam pilorum canorum utroque latere; legumine non viso.

A slender, slightly glutinous, and scantily hoary shrub; branchlets angular; stipules small, scarious, semi-persistent. Phyllodia narrow-lanceolate, tapering into a very small, villose petiole, and usually ending in a minute, oblique point, more or less prominently binerved, with numerous very fine parallel veins between them, 4-7 cm. long, 5-8 mm. broad; gland basal, linear, like a narrow slit. Spikes pedunculate, single or in pairs cylindrical; peduncles hairy. Buds globular; flowers small, pale yellow. Calyx cupular, sinuolate, ciliate. Petals 5, free, papery, with a faint central nerve, more than twice the length of the calyx. Bracts small, capitate, ciliate. Ovary with two rows of very fine white hairs, otherwise glabrous. Pod not seen.

Walmudja, Roper River, Northern Territory (N. B. Tindale, No. 24, May, 1921). The type.

Very closely allied to *A. Hammondi,* from which it may be distinguished in the tomentum, different shaped calyx, and in the totally different gland.

58. **A. lentiginea,** n. sp.

Plate xxi.

Frutex patens 4-10 altus, ramulis erectis, angulatis; phyllodiis augusto-lanceolatis vel falcato-lanceolatis, leviter resinosis, 3-4 nerviis, 5-10 cm. longis, ½-1 cm. latis; spicis pedunculatis, gracilibus, cylindraceis; floribus parvis, 4-5 meris, sepalis lineari-spathulatis, glabris; petalis 4-5, liberis, lineari-lanceolatis, leviter carinatis, calyce duplo longioribus; ovario laevi; legumine non viso.

A spreading shrub, 4-10 feet high, with numerous erect, wiry, somewhat angular, punctate branchlets, and a rough fibrous-flaky bark. Phyllodia punctate with minute white dots, narrow-lanceolate to falcate-lanceolate, green and glutinous, with 3-4 prominent nerves, and several very fine longitudinal lines between them, 5-10 cm. long, ½-1 cm. broad; gland fairly prominent, a short distance from the base and swollen on both sides of the marginal nerve. Spikes shortly pedunculate, slender, cylindrical, bearing very pale-yellow, papery, 4-5 merous flowers. Sepals linear, free, spathulate, glabrous. Petals smooth, free, rather broad, with a faint central nerve, scarcely twice the length of the sepals. Bracts obliquely capitate. Ovary glabrous. Pod not seen. They are narrow-linear, according to Gardner. There is portion of a loose pod attached to the sheet of No. 296, but it is difficult to say whether it is properly matched with the specimen. It is narrow and somewhat woody, and more or less quadrangular with the seeds obliquely arranged. The phyllodes of No. 296 seem to match the phyllodes of No. 1369; both specimens are minutely punctate with microscopic white dots, hence the specific name.

Hills near the Prince Regent River, in scanty sandy soil in crevices of sandstone rocks (C. A. Gardner, No. 1369). The type. Third Voyage of the "Mermaid," A. Cunningham, No. 296, 1820.

Near *A. plectocarpa*, but the phyllodes are somewhat different, and the flowers are quite glabrous. It resembles *A. Hemsleyi* somewhat in the phyllodes, but is distinct in the buds, glabrous flowers, and different shaped bracts. It has almost the same shaped phyllode as *A. loxocarpa* and *A. drepanocarpa*, but the pods are quite different.

59. A. ancistrocarpa, n. sp.

Plate xxi.

Frutex gracilis, glaber, 6-15′ altus; ramis leviter angulatis, surculis iunioribus glutinosis; phyllodiis lineari-lanceolatis, pallido-viridibus, nitentibus, obscure trinerviis, 7-12 cm. longis, 5-8 mm. latis, biglandularibus; spicis glabris, cylindraceis; calyce patellaformi, leviter tomentoso; petalis laevibus circiter dimidio longitudinis iunctis, calyce triplo longioribus; ovario tomentoso, legumine coriaceo, angusto-oblongo, undulato, uncinato, 4-5 cm. longo, 7mm. lato; seminibus ovatis, oblique dispositis; funiculo brevi, crasso.

A slender, glabrous shrub up to 15 feet high, with slightly angular, pale-coloured branchlets; young shoots resinous. Phyllodia linear-lanceolate, pale green, somewhat shining, faintly trinerved, or the central nerve alone conspicuous, with numerous very fine, longitudinal lines between them, 7-12 cm. long, 5-8 mm. broad; glands two, one close to the base, the other about 3cm. from the base. Spikes pedunculate, glabrous, cylindrical. Calyx very shallow, almost saucer-shaped, slightly tomentose sinuolate. Petals smooth, united for more than half their length, fully three times longer than the calyx. Ovary slightly tomentose. Pods stipitate, oblong-lanceolate, coriaceous, undulate, the apex usually uncinate, 4-5 cm. long, 7 mm. broad. Seeds ovate, obliquely arranged, with pithy partitions between the seeds. Funicle short, thickened into a cap-shaped aril over the end of the seed.

Northern Territory. Barrow Creek, in flower, and with narrow phyllodia (Captain S. A. White, No. 81 ; Darwin to Pine Creek, tree 15 feet high (Dr. H. I. Jensen, per C. E. F. Allen, No. 209).

Western Australia. Between Minderoo and Globe Hill, Ashburton River, in pod (Dr. A. Morrison, 29th September, 1905).

Affinities. With *A. pachycarpa* and *A. plectocarpa*, but differing from both in the phyllodia and in the pod.

60. A. Cunninghamii Hook., var. tropica, n. var.

Plate xxii.

Frutex glaber; ramulis acute angularibus, surculis iunioribus plus minus resinosis; phyllodiis angustis ad lato-lanceolatis, basi obliquis, obtusis vel apice crassiusculis, trinerviis, lineis numerosis, longitudinalibus tenuibus inter nervos, 7-12 cm. longis, 1.5-3 cm. latis; spicis pedunculatis, cylindraceis 3 vel 4 simul; calyce cupulare, brevissimo, sinuolato, ciliato; petalis 5 basin versus iunctis, crassis, carinatis, calyce plus triplo longioribus; ovario hirsuto, late ovoid; legumine non viso.

A glabrous shrub, with somewhat acutely angular branchlets, and more or less glutinous young tips. Phyllodia narrow to broad-lanceolate, gradually tapering obliquely into a long petiole, obtuse, or the apex more or less thickened, trinerved, the two lowest nerves usually confluent for about 15 mm. from the base, and with numerous fine, parallel veins between them above their junction, also with a few irregular anastomosing veins, 7-12 cm. long, 1.5-3 cm. broad, gland small; inserted at the base of the lamina. Spikes

pedunculate, in pairs or sometimes 3 or 4 together, cylindrical, 3.5 to 6.5 cm. long. Flowers moderately large; buds globular. Calyx very short, cupular, sinuolate, ciliate. Petals 5, divided to a little below the middle, thick, keeled, more than three times longer than the calyx. Ovary ovate, hirsute. Young pods linear, usually flexuose, not seen fully ripe.

Hell Gate, Roper River, Northern Territory (Prof. W. Baldwin Spencer, 2nd August, 1911).

Differing from the typical *A. Cunninghamii* in the uniformly trinerved phyllodia, much longer petiole, smaller gland, denser spikes, more slender and longer peduncles, smaller calyx, and more coriaceous keeled petals. The calyx and corolla are markedly persistent after the stamens have fallen, see fig. 3, Plate 22.

61. A. Gardneri, n. sp.

Plate xxii.

Frutex gracilis, glaber, 6-15′ altus; ramulis patentibus, leviter compresso-teretibus, glaucis; phyllodiis leviter glaucis, late et oblique lanceolato-falcatis, in basis angustatis, 4-nerviis, 8-12 cm. longis, 2-3 cm. latis; spicis gracilibus, cylindraceis flores parvos, glabros, sulphureos gerentibus; calyce cupulari, sinuolato; petalis liberis, angusto-lanceolatis, acutis, calyce triplo longioribus; ovario glabro; legumine lineari, stipitato, flexuoso inter semina incincto, 5-8 cm. long, 3-4 mm. lato; seminibus longitudinalibus; funiculo basi in arillum clavatum incrassato.

A slender, glabrous, erect shrub, 6-15 feet high, with a smooth brown bark covered in the upper portion with a white powder. Branchlets spreading, slightly compressed-terete, and more or less glaucous. Phyllodia slightly glaucous, broadly and obliquely falcate-lanceolate, narrowed into the base, 4-nerved, with fine anastomosing veins between them, the two lower nerves uniting a short distance from the base, 8-12 cm. long, 2-3 cm. broad, gland small, at the extreme base of the lamina. Spikes pedicellate, very slender, cylindrical, 4-5 cm. long, bearing small light-yellow, glabrous flowers. Calyx cupular, sinuolate. Petals 5, free, linear-lanceolate, concave, slightly keeled, nearly three times longer than the calyx. Ovary glabrous. Pod linear, stipitate, flexuose, 5-8 cm. long, 3-4 mm. broad, slightly constricted between the seeds; valves thinly coriaceous. Seeds longitudinally arranged, dark brown, oblong. Funicle filiform for more than half its length, with one short central fold, then gradually thickened into a long club-shaped aril.

Near Prince Regent River, on the banks of streams in sandy soil, among quartzite rocks (C. A. Gardner, No. 1368, 12th June, 1921), also seen on the Moran and King Edward Rivers; Packhorse Range (W. V. Fitzgerald, No. 1253, July, 1905); Charnley River (W. V. Fitzgerald, August, 1905).

Near *A. cincinata* in the shape of the phyllodes, but quite different in the pod. It resembles *A. tumida* in general appearance, but the venation of the phyllodia is different, and so are the pods. The phyllodes are the same shape as those of *A. leptocarpa*, but the venation is different. The pods also resemble those of the latter species.

We are deeply indebted to Dr. G. P. Darnell-Smith, Director of the Botanic Gardens, Sydney, who has given us every facility to complete the work, and to Miss M. Flockton and Miss E. King, joint artists, for the splendid illustrations and for assistance in other directions, also to Mr. C. A. Gardner, of the Botanical Branch of the Department of Agriculture, Perth, for material and field notes of a number of species.

Explanation of Plates.

(All enlarged except where otherwise stated.)

PLATE I.

A. pulviniformis, n. sp.

1, floworing twig, nat. size; 2, phyllodes and deciduous stipules; 3, showing the attachment of the phyllodes; 4, a cluster of bracts at the base of the peduncle; 5, head of flowers; 6, flower; 7, ovary.

A. sulcata var. *hirsuta*, n. var.

8, flowering twig, nat. size; 9, portion of branch, base of phyllodes, and stipules greatly enlarged; 10, head of flowers; 11, flower; 11*a*, bract; 12, ovary.

A. sedifolia, n. sp.

13, flowering twig, nat. size; 14, phyllode; 15, head of flowers; 16, bract; 17, flower; 18, ovary.

PLATE II.

A. excentrica, n. sp.

1, flowering twig, nat. size; 2, phyllode showing the excentric nerve; 3, showing tho attachment of the phyllode, and the persistent, pilose stipules; 4, bract; 5, flower; 6, ovary.

A. calcarata, n. sp.

7, flowering twig, nat. size; 8, showing the attachment of the phyllode and the spur-like stipules; 8*a*, portion of phyllode showing the prominent nerves and gland; 9, tip of phyllode; 10, bract; 11, flower; 12, ovary.

PLATE III.

A. acellerata, n. sp.

1, flowering twig, nat. size; 2, showing attachment of the phyllode and small gland (*a*); 3, bract; 4, flower; 5, ovary.

A. inops, n. sp.

6, flowering twig, nat. size; 7, showing sessile phyllode, basal gland, and the stipules; 8, elliptical bud; 9, bract; 10, flower; 11, ovary.

A. glabriflora, n. sp.

12, flowering twig, nat. size; 13, an elliptical phyllode, nat. size; 14, showing attachment of phyllode and the small gland at the extreme base; 15, head of flowers; 16, bract; 17, flower; 18, ovary.

PLATE IV.

A. fragilis, n. sp.

1, flowering twig, nat. size; 2, a long phyllode; 3, showing the base of the phyllode and attachment; 4, portion of the phyllode showing the channels, which is rather diagrammatic; 5, showing the semiplumose tip of phyllode; 6, head of flowers; 7, bract; 8, flower; 9, ovary; 10, pod, nat. size; 11, seed and funicle.

A. eremophila, W. V. Fitz., var. *variabilis*, n. var.

12, flowering twig, nat. size; 13, long phyllode; 14, showing attachment of phyllode; 15, bract; 16, flower; 17, ovary; 18, pod, nat. size; 19, portion of pod showing the tomentum; 20, seed and funicle.

PLATE V.

A. obtecta, n. sp.

1, flowering twig, nat. size; 2, flower; 3, bract; 4, ovary; 5, pod; 6, seed and funicle in situ.

A. Inceae, n. sp.

7, flowering twig, nat. size; 8, flower; 9, bract; 10, ovary.

A. abrupta, n. sp.

11, flowering twig, nat. size; 12, base of phyllode showing attachment and the linear gland on the nerve; 13, apex of phyllode; 14, head of flowers; 15, flower; 16, bract; 17, ovary.

PLATE VI.

A. viscifolia, n. sp.

1, flowering twig, nat. size; 2, branchlet and base of phyllode showing the small circular gland; 3, tip of phyllode; 4, head of flower; 5, flower; 6, bract; 7, ovary.

A. Maxwelli, n. sp.

8, flowering twig, nat. size; 9, portion of branchlet showing the stipules; 10, showing the attachment of the phyllode; 11, phyllode greatly enlarged; 12, flower; 13, ovary.

A. semiaurea, n. sp.

14, flowering twig, nat. size; 15, a broad phyllode showing the position of the gland; 16, base of phyllode; 17, bract; 18, flower; 19, ovary.

A. chrysopoda, n. sp.

20, portion of flowering twig; 21, phyllode, greatly enlarged; 22, head of flowers; 23, flower; 24, bract; 25, ovary.

PLATE VII.

A. Merrickae, n. sp.

1, flowering twig, nat. size; 2, tip of phyllode showing muero; 3, head of flowers; 4, types of floral bracts; 5, flower; 6, ovary; 7, twig bearing young pods, nat. size; 8, showing the longitudinal position of the seed and the remarkably long funicle.

A. orbifolia, n. sp.

9, flowering twig, nat. size; 10, phyllode, enlarged, showing the fimbriate border; 11, flower; 12, ovary; 13, very young pod.

A. oblonga, n. sp.

14, flowering twig, nat. size; 15, phyllode showing the obscure venation and the small gland at the extreme base; 16, bract; 17, flower; 18, ovary.

PLATE VIII.

A. semicircinalis, n. sp.

1, flowering twig, nat. size; 2, phyllode; 3, bracts; 4, flower; 5, ovary; 6, immature pod.

A. subretusa, n. sp.

7, flowering twig, nat. size; 8, showing attachment of phyllode; 9, bract; 10, flower; 11, ovary.

A. enervia, n. sp.

12, flowering twig, nat. size; 13, a much larger phyllode than 12; 14, base of phyllode showing the position of the gland; 15, flower; 16, bract; 17, ovary; 18, pod, nat. size; 19, section of pod showing position of the seed and funicle.

A. pallidiramosa, n. sp.

20, twig, nat. size; 21, showing the attachment of the phyllodia and the small marginal gland; 22, seed and funicle.

PLATE IX.

A. de exa, n. sp.

1, flowering twig, nat. size; 2, showing the attachment of the phyllode, venation, and vestiture; 3, head of flowers, with floral bracts; 4, bract; 5, flower; 6, ovary.

A. Kingiana, n. sp.

7, flowering twig, nat. size; 8, head of buds showing the peduncle, bracteoles attachment of phyllode, gland and vestiture; 9, bract; 10, flower; 11, ovary.

PLATE X.

A. glutinosissima, n. sp.

1, flowering twig, nat. size; 2, showing the attachment and base of phyllode; 3, tip of phyllode; 4, bract; 5, flower; 6, a very young pod.

A. bracteata, n. sp.

7, flowering twig, nat. size; 8, a bud; 9, bract; 10, flower; 11, ovary.

PLATE XI.

A. acutifolia, n. sp.

1, flowering branch, nat. size; 2, portion of branchlet and base of phyllode; 3, ovary; 4, flower.

A. validinervia, n. sp.

5, flowering twig, nat. size; 6, flower; 7, bract; 8, ovary.

PLATE XII.

A. chrysella, n. sp.

1, flowering twig, nat. size; 2, attachment of phyllode; 3, flower; 4, bract; 5, ovary; 6, pod, nat. size; 7, seed and funicle.

A. Steedmani, n. sp.

8, flowering twig, nat. size; 9, phyllode, showing the three marginal glands; 10, flower; 11, bracts; 12, ovary; 13, pod, nat. size; 14, seed and funicle.

PLATE XIII.

A. subglauca, n. sp. var. *angustiuscula*, n. var.

1, attachment of phyllode; 2, flowering twig, nat. size; 3, head of flowers; 4, flower; 4*a*, ovary; 5, bract.

A. subglauca, n. sp.

6, flowering twig, nat. size; 7, portion of phyllode showing position of gland; 8, tip of phyllode; 9, flower; 10, types of bracts; 11, ovary; 12, pod, nat. size; 13, section of pod showing the seed and funicle in situ.

PLATE XIV.

A. pachyacra, n. sp.

1, flowering twig, nat. size; 2, base of phyllode showing the large gland; 3, tip of phyllode showing the thick apex; 4, head of flowers; 5, flower; 6, bract; 7, ovary.

A. *subangularis*, n. sp.

8, flowering twig, nat. size; 9, attachment of phyllode showing the strong central nerve, also cross section; 10, flower; 11, bract; 12, ovary.

PLATE XV.

A. malloclada, n. sp.

1, flowering twig, nat. size; 2, phyllode showing vestiture, venation, apex and basal gland; 3, flower; 4, bracts; 5, ovary.

A. Websteri, n. sp.

6, flowering twig, nat. size; 7, base of phyllode showing attachment; 8, flower; 9, bract; 10, ovary; 11, pod, nat. size; 12, seed and funicle.

A. sphaerogemma, n. sp.

13, flowering twig, nat. size; 14, base of phyllode showing vestiture and venation; 15, front edge of phyllode to show the long basal gland; 16, spherical bud; 17, flower; 18, ovary.

PLATE XVI.

A. inophloia, n. sp.

1, flowering twig, nat. size; 2, base of phyllode showing vestiture and attachment; 3, flower; 4, ovary.

A. sessilispica, n. sp.

5, flowering twig, nat. size; 6, base of phyllode showing attachment and venation; 7, flower; 8, ovary; 9, pod, nat. size; 10, portion of pod to show the seed and funicle.

PLATE XVII.

A. desertorum, n. sp.

1, flowering twig, nat. size ; 2, base of phyllode showing gland ; 3, portion of phyllode to show venation ; 4, flower spike, nat. size ; 5, flower ; 6, bract ; 7, ovary

A. Jibberdingensis, n. sp.

8, flowering twig, nat. size ; 9, base of phyllode showing attachment and venation ; 10, portion of phyllode to show the venation, vestiture, and one of the five glands ; 11, flower ; 12, ovary ; 13, portion of pod, nat. size.

PLATE XVIII.

A. Fauntleroyi, n. sp.

1, flowering twig, nat. size ; 2, a long phyllode, nat. size ; 2*a*, portion of phyllode to show the venation ; 3, flower ; 4, bract ; 5, ovary ; 6, pod, nat. size ; 7, seed and funicle.

A. glabripes, n. sp.

8, flowering twig, nat. size ; 9, phyllode and spike. nat. size ; 10, base of phyllode ; 11, flower ; 12, ovary ; 13, bract.

PLATE XIX.

A. Clementi, n. sp.

1, flowering twig, nat. size ; 2, flower ; 3, bract ; 4, ovary.

A. numerosa, n. sp.

5, flowering twig, nat. size ; 6, flower ; 7, bract ; 8, ovary ; 9, pod.

A. eriopoda, n. sp.

10, phyllode showing attachment, nat. size ; 11, base of phyllode ; 12, portion of flowering twig ; 13, flower ; 14, linear bract ; 15, ovary.

PLATE XX.

A. cognata n. sp.

1, flowering twig, nat. size ; 2, base of phyllode to show attachment and the very small gland : 3, flower ; 4, bract ; 5, ovary.

A. adsurgens, n. sp.

6, flowering twig, nat. size ; 7, base of phyllode to show attachment and large gland ; 8, flower with six petals ; 9, flower with five short broad petals ; 10, ovary.

PLATE XXI.

A. ancistrocarpa, n. sp.

1, flowering and fruiting twig, nat. size ; 2, base of phyllode to show attachment, venation and gland ; 3, flower ; 4, bract ; 5, ovary ; 6, portion of pod showing position of seed and funicle.

A. lentiginea, n. sp.

7, flowering twig, nat. size ; 8, flower ; 9, bract ; 10, ovary.

A. Jutsoni Maiden.

11, pods, nat. size ; 12, portion of pod to show the seed and funicle.

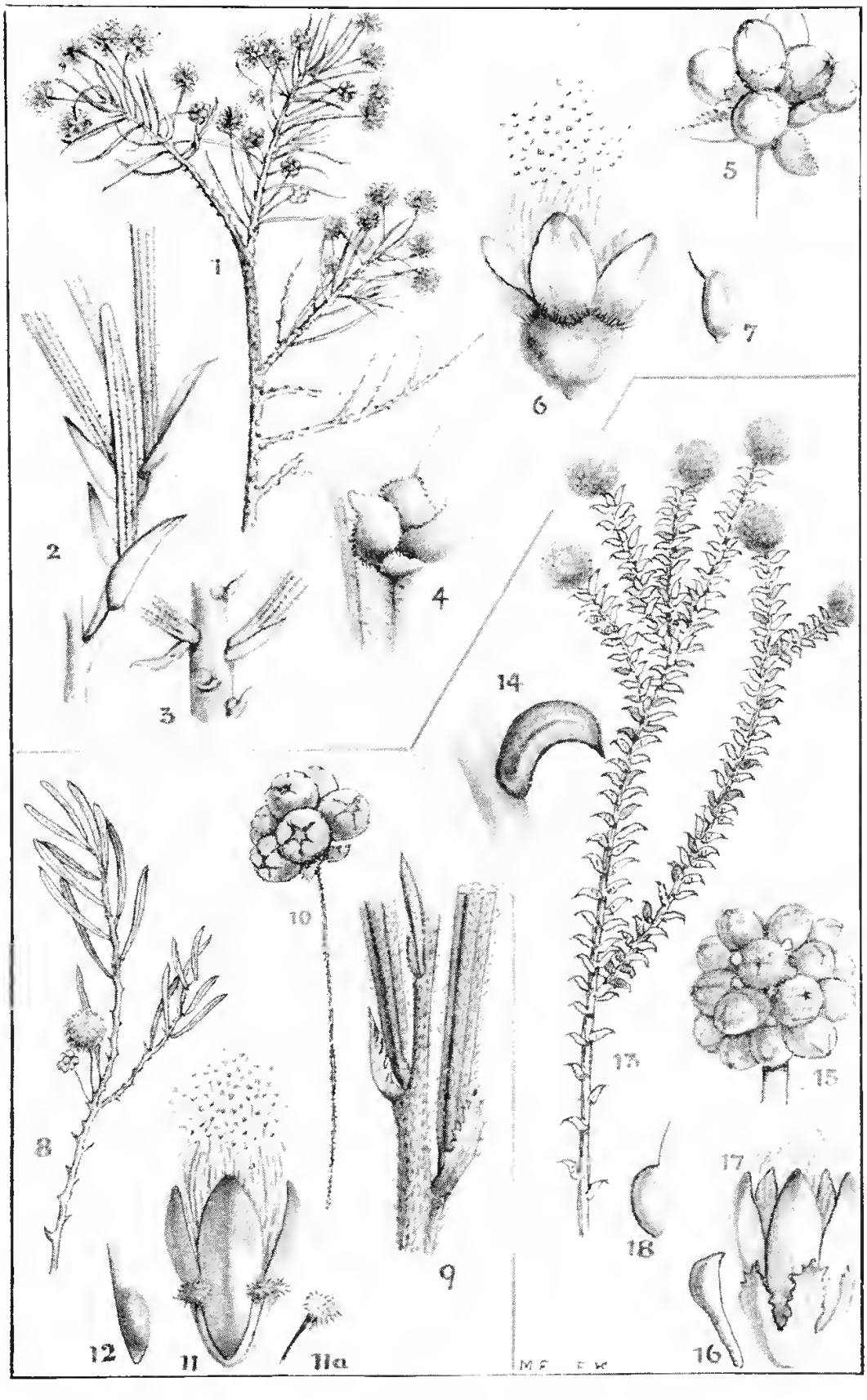
PLATE XXII.

A. Cunninghamii, Hook. var. *tropica*, n. var.

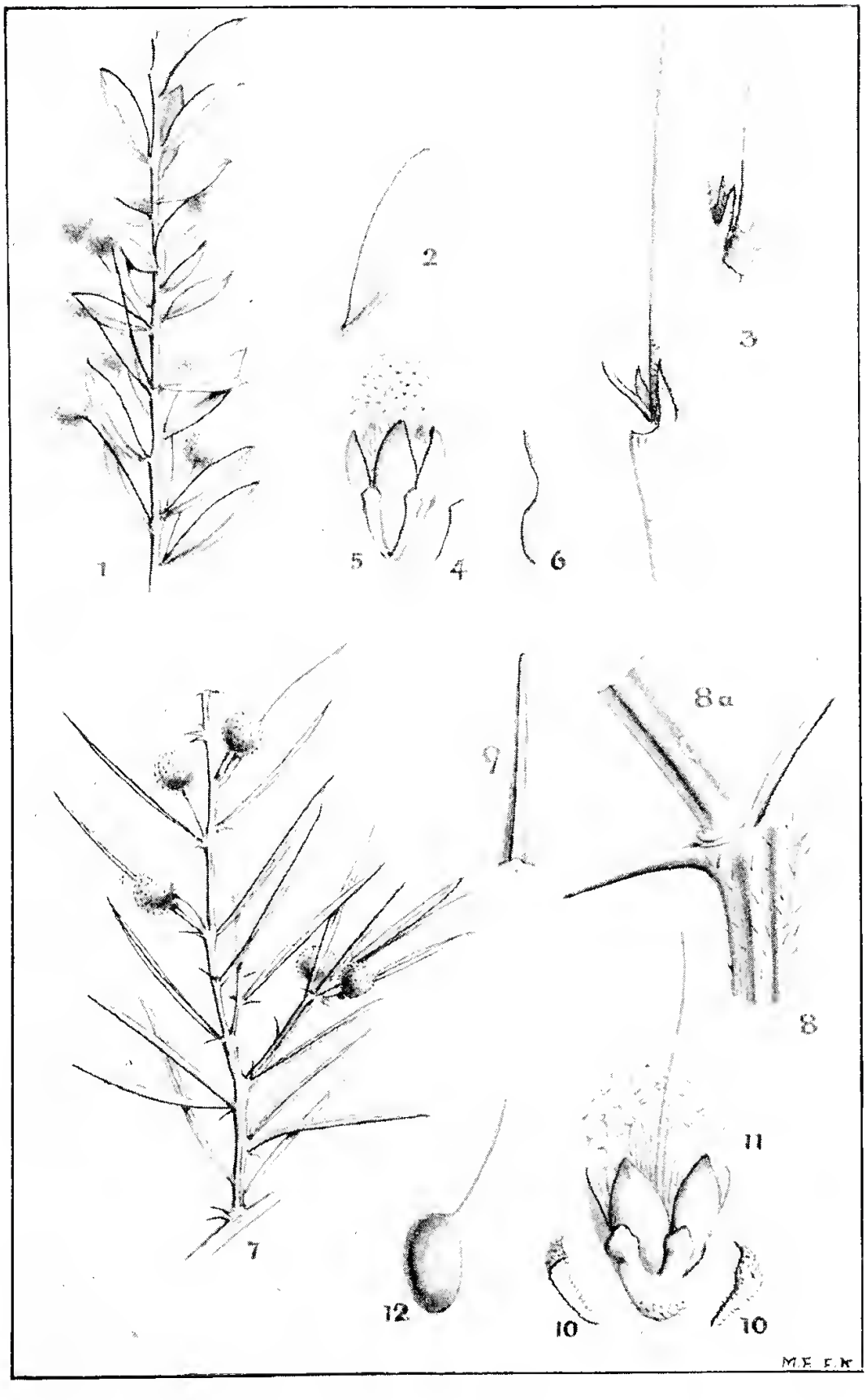
1, flowering twig, nat. size ; 2, phyllode, nat. size ; 3, slender raehis, nat. size, to show the persistent flowers after the stamens have fallen, also two immature pods ; 4, flower ; 5, ovary.

A. Gardneri, n. sp.

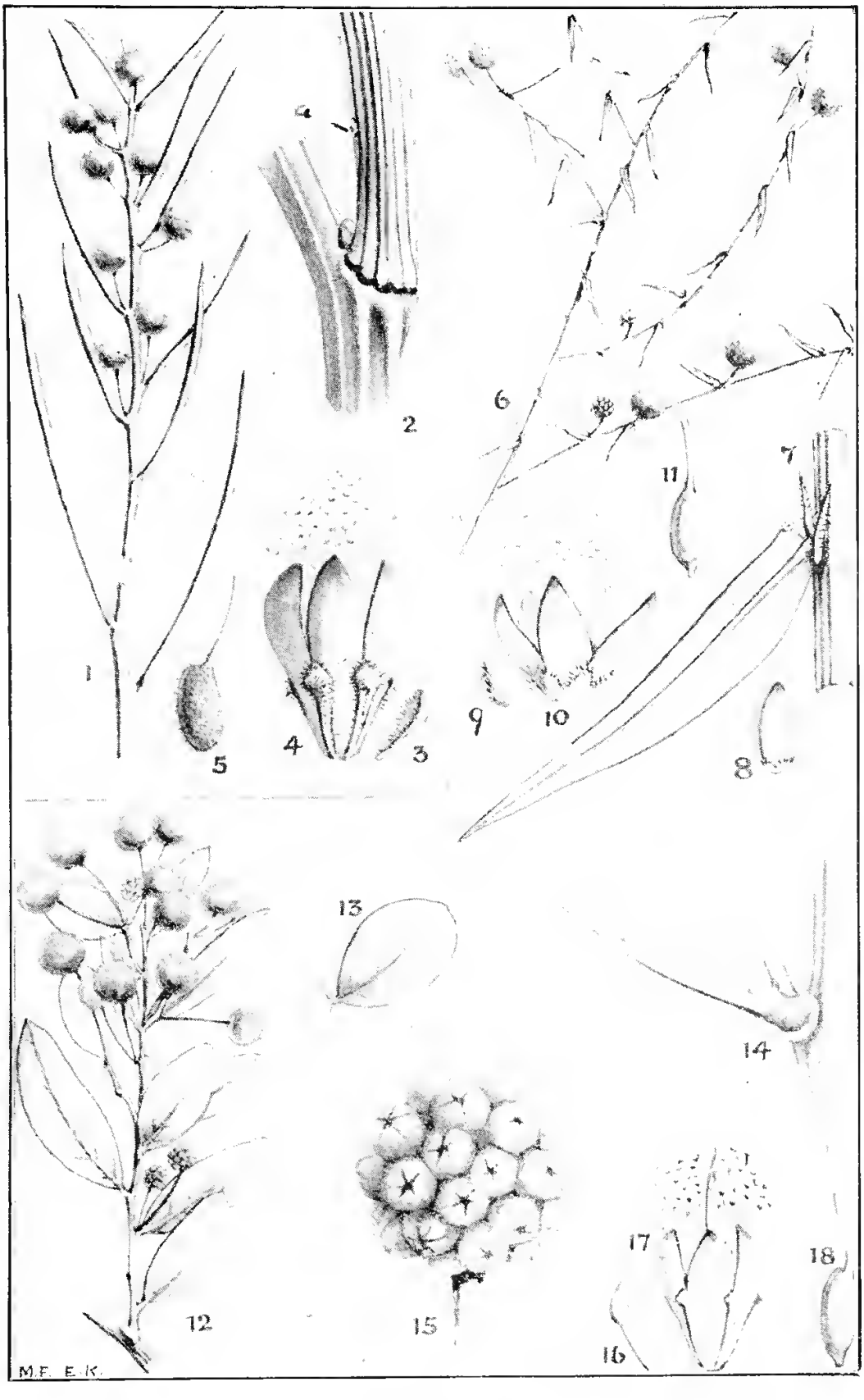
6, portion of flowering twig, nat. size ; 7, twig showing buds ; 8, flower ; 9, ovary ; 10, pod, nat. size ; 11, portion of pod to show the long funicle and seed.



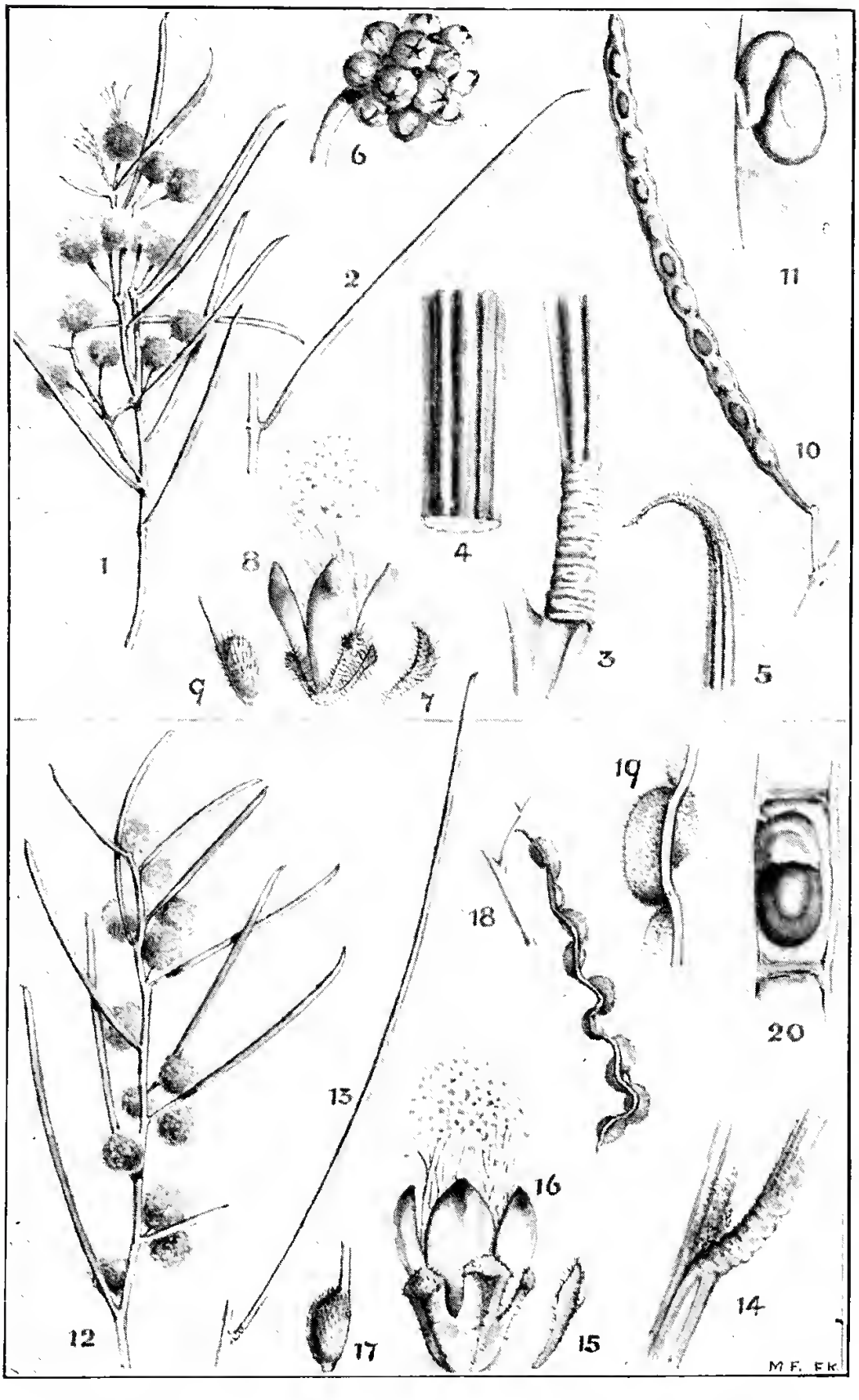
A. pulviniformis n. sp. (1-7). *A. sulcata* R.Br. var. *hirsuta* n. var. (8-12). *A. sedifolia* n. sp. (13-18).



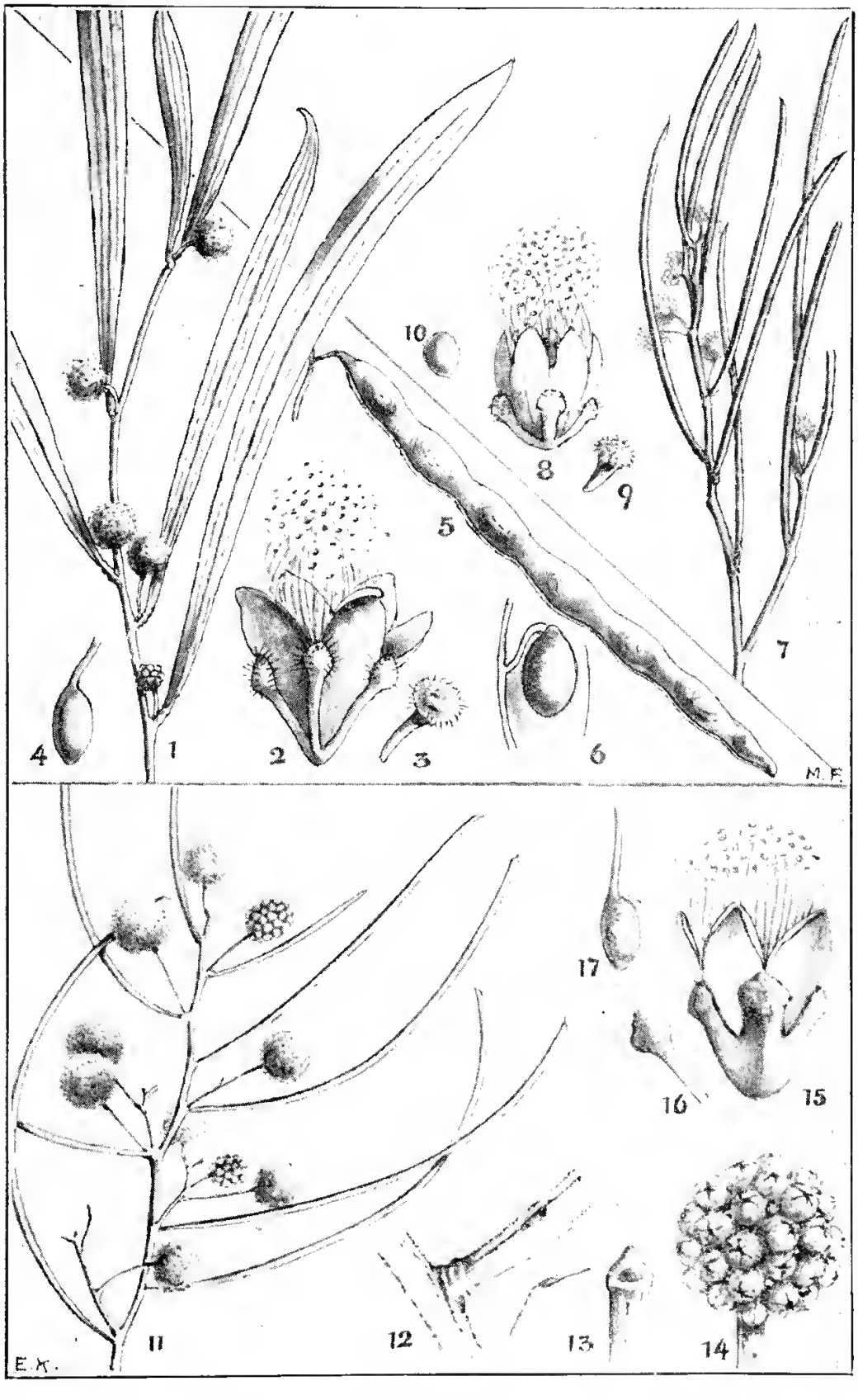
A. excentrica n. sp. (1-6). *A. calcarata* n. sp. (7-12).



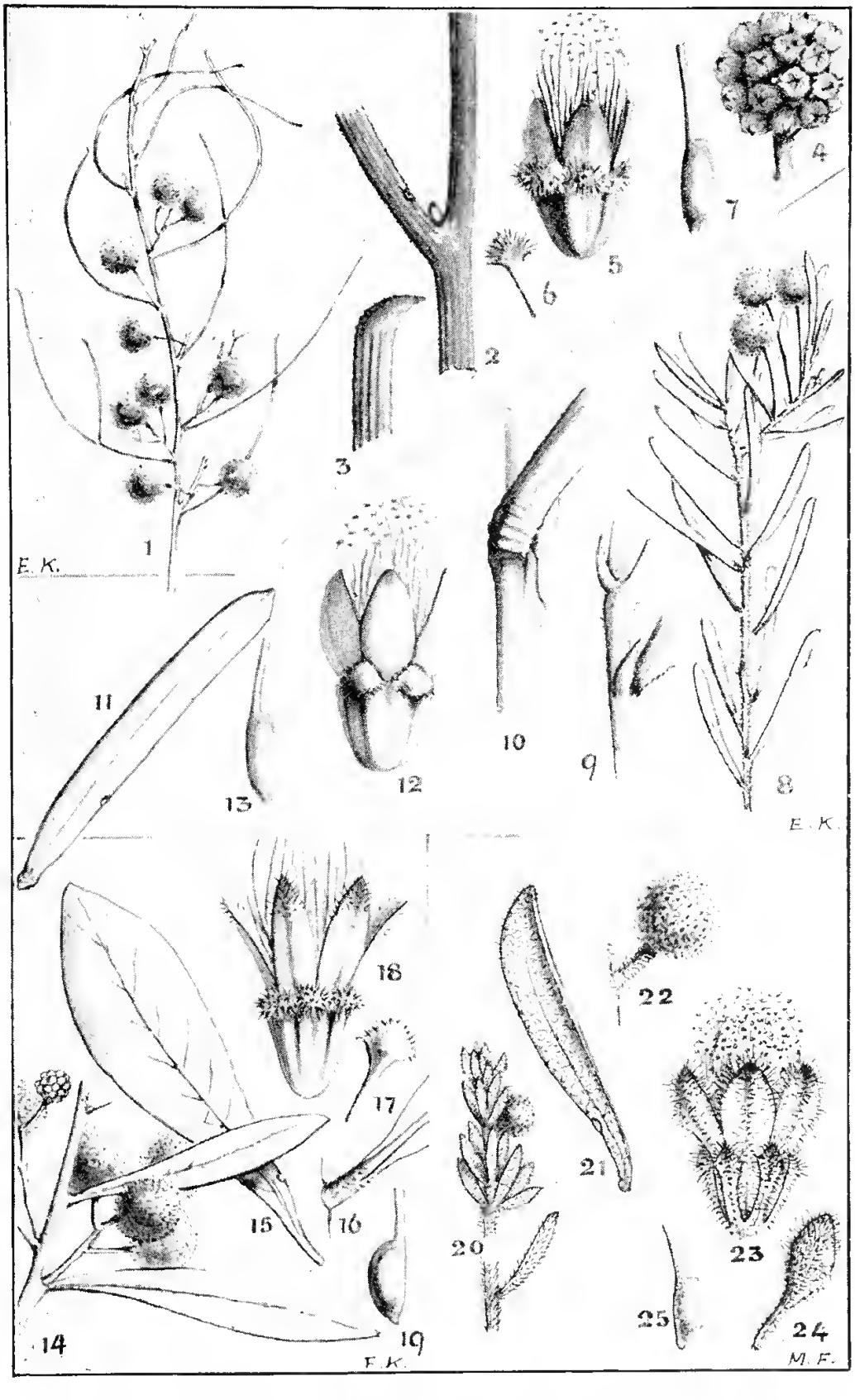
A. acellerata n. sp. (1-5). *A. inops* n. sp. (6-11). *A. glabriflora* n. sp. (12-18).



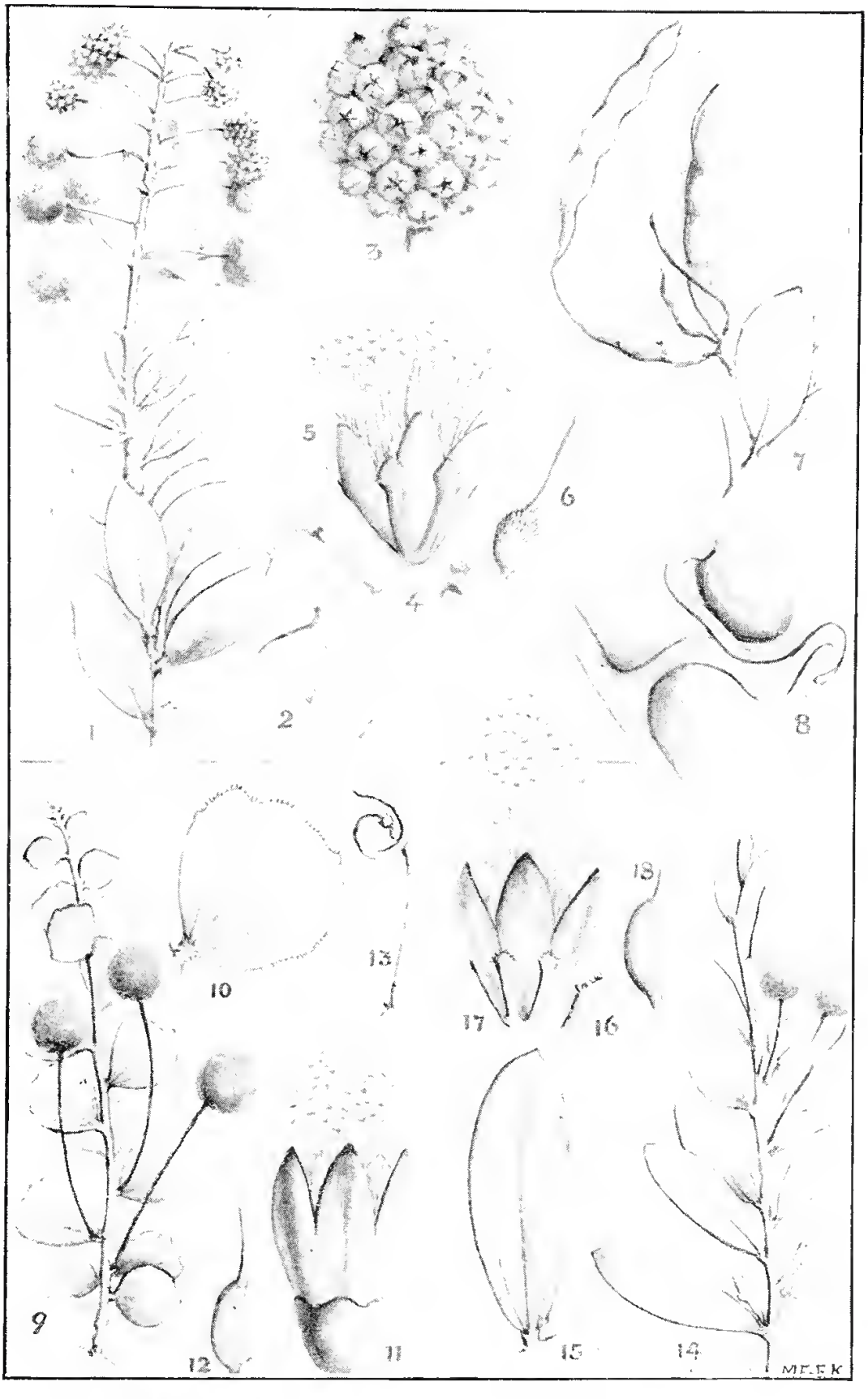
A. fragilis n. sp. (1-11). *A. eremophila* W. V. Fitz., var. *variabilis* n. var. (12-19).



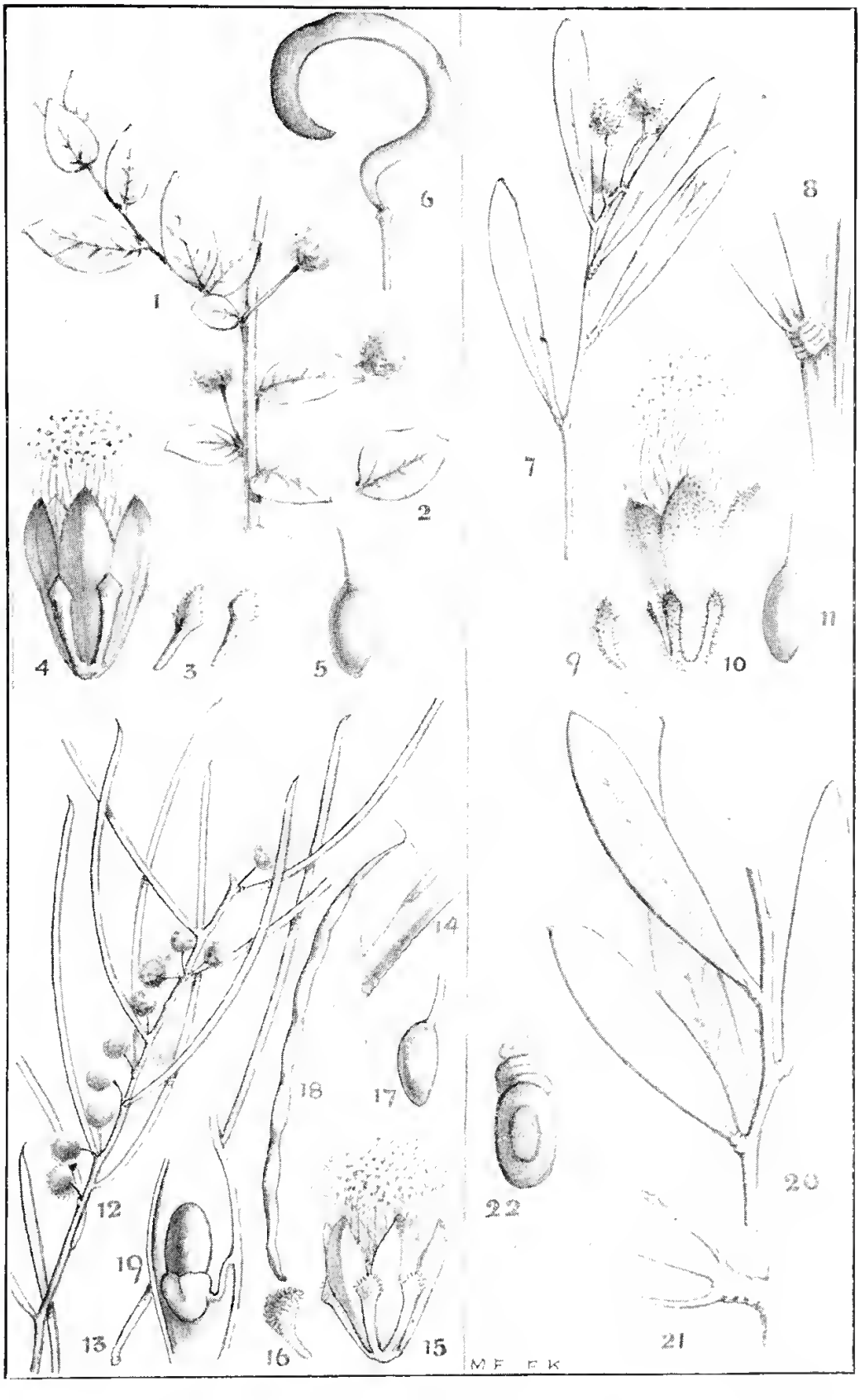
A. obtecta n. sp. (1-6). *A. Inceae* n. sp. (7-10). *A. abrupta* n. sp. (11-17).



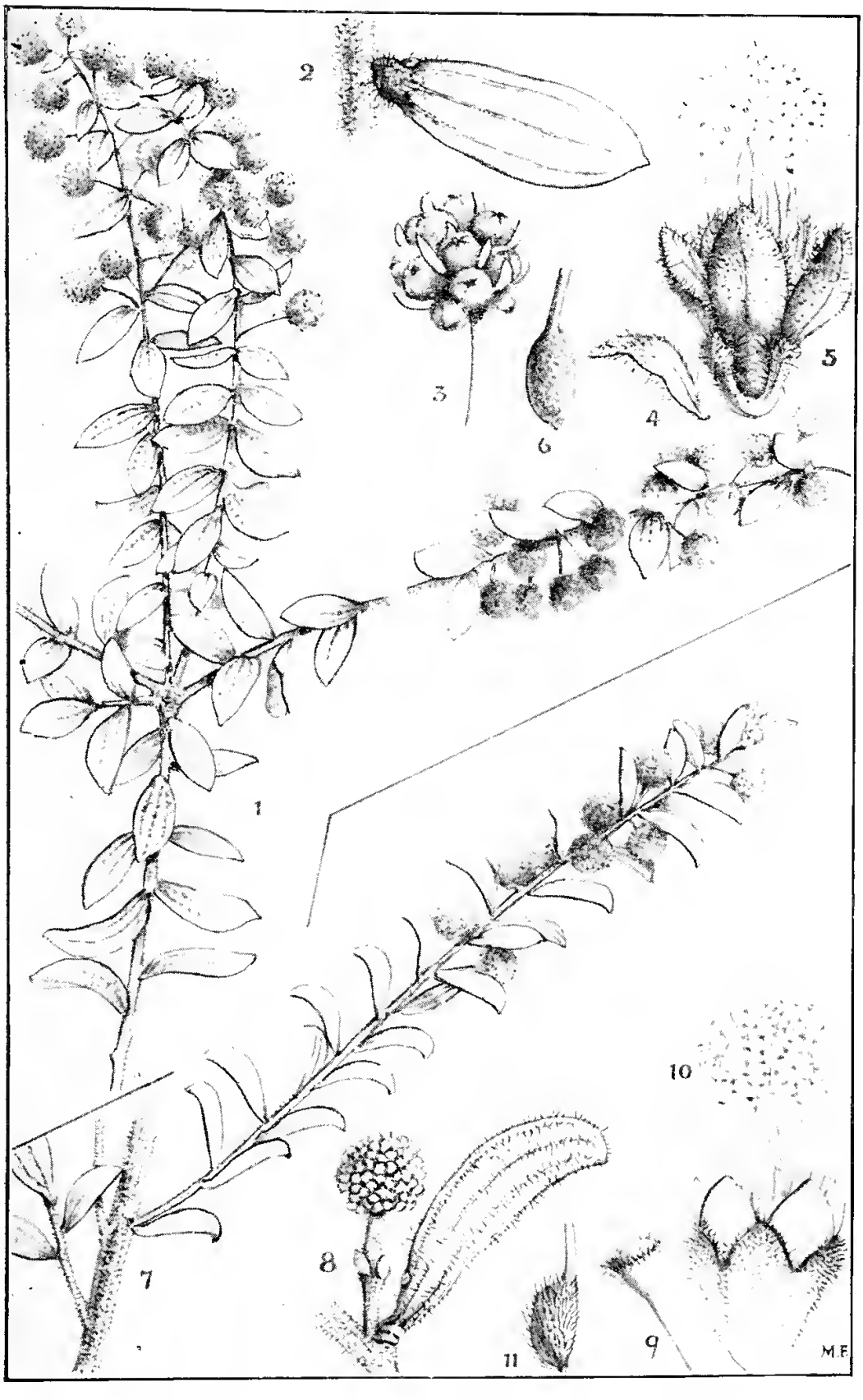
A. viscifolia n. sp. (1-7). *A. Maxwelli* n. sp. (8-13). *A. semiaurea* n. sp. (14-19). *A. chrysopoda* n. sp. (20-25).



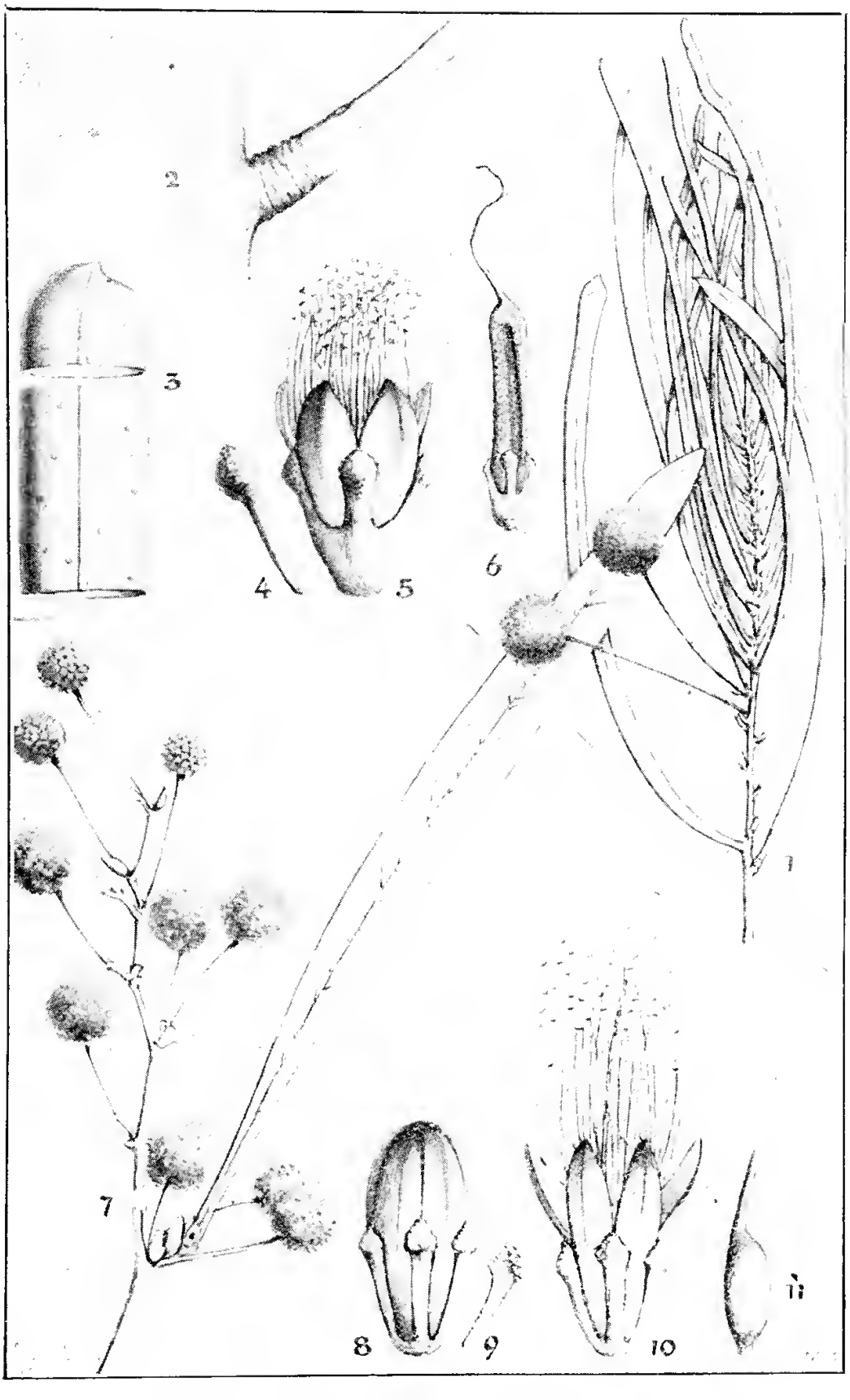
A. Merrickae n. sp. (1-8). *A. orbifolia* n. sp. (9-13). *A. oblonga* n. sp. (14-18).



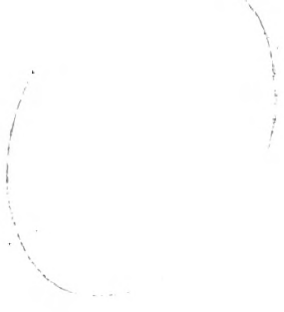
A. semicircinalis n. sp. (1-6). *A. subretusa* n. sp. (7-11). *A. enervia* n. sp. (12-19). *A. pallidiramosa* n. sp. (20-22).

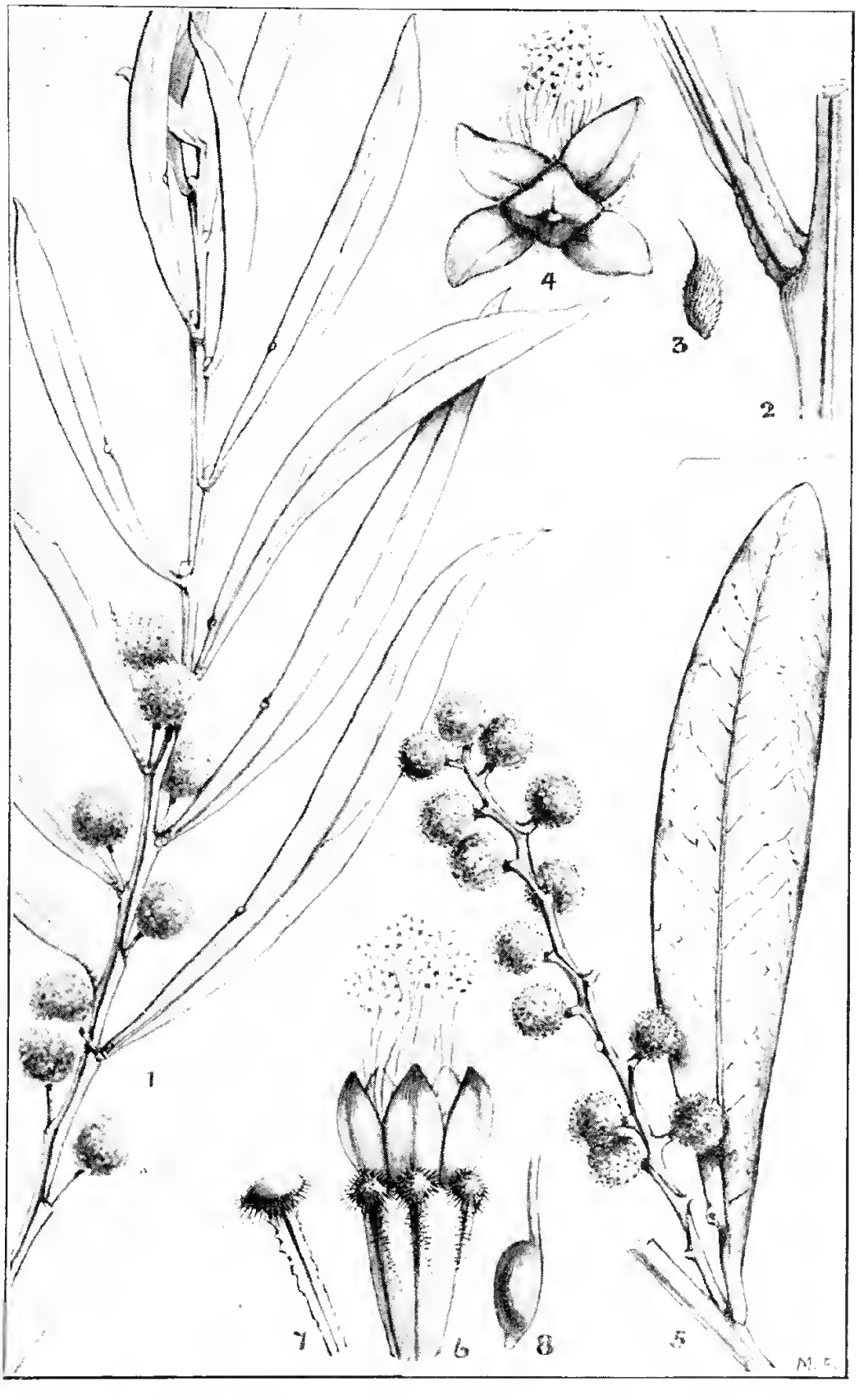


A. deflexa n. sp. (1-6). *A. Kingiana* n. sp. (7-11).

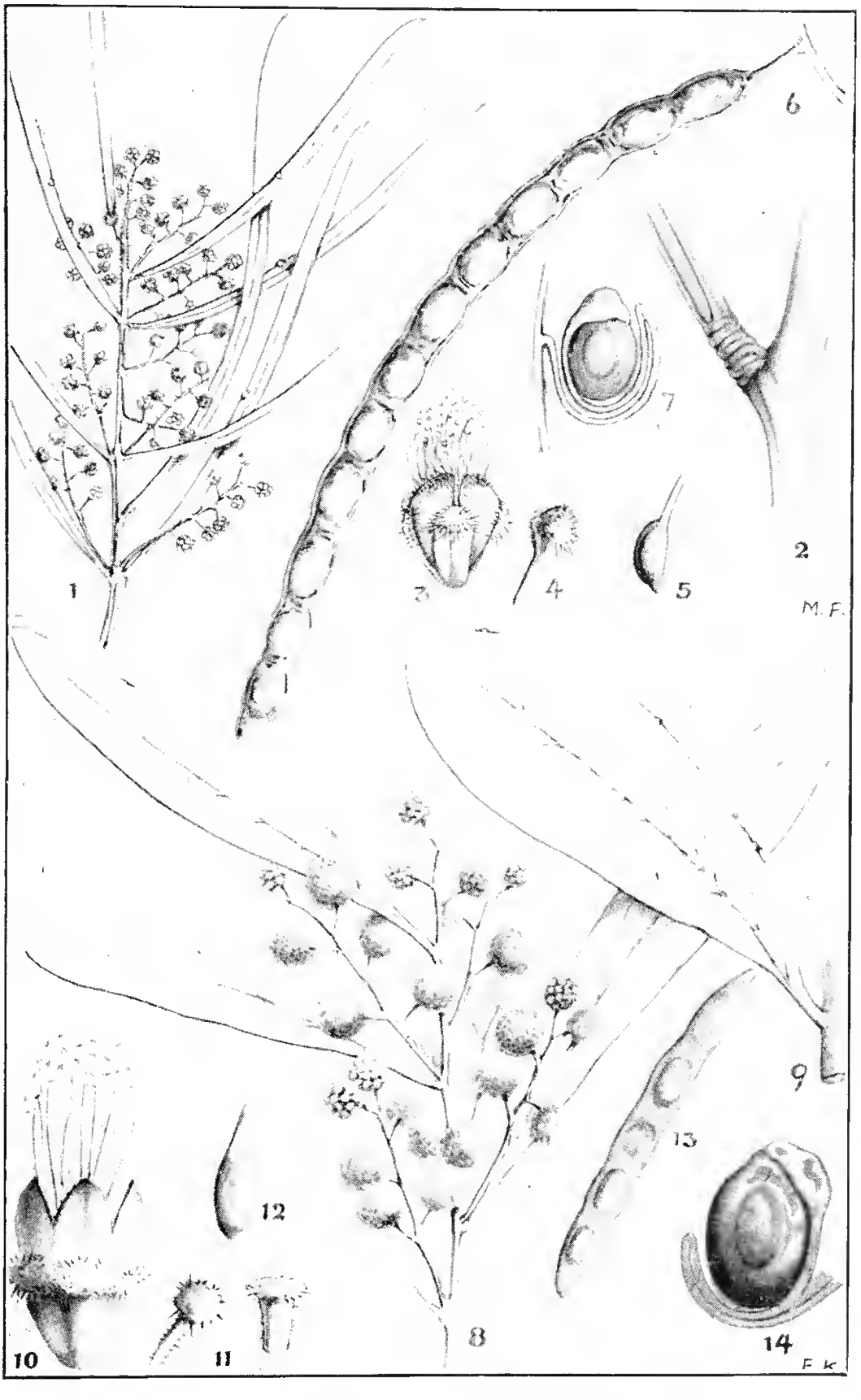


A. glutinosissima n. sp. (1-6). *A. bracteata* n. sp. (7-11).

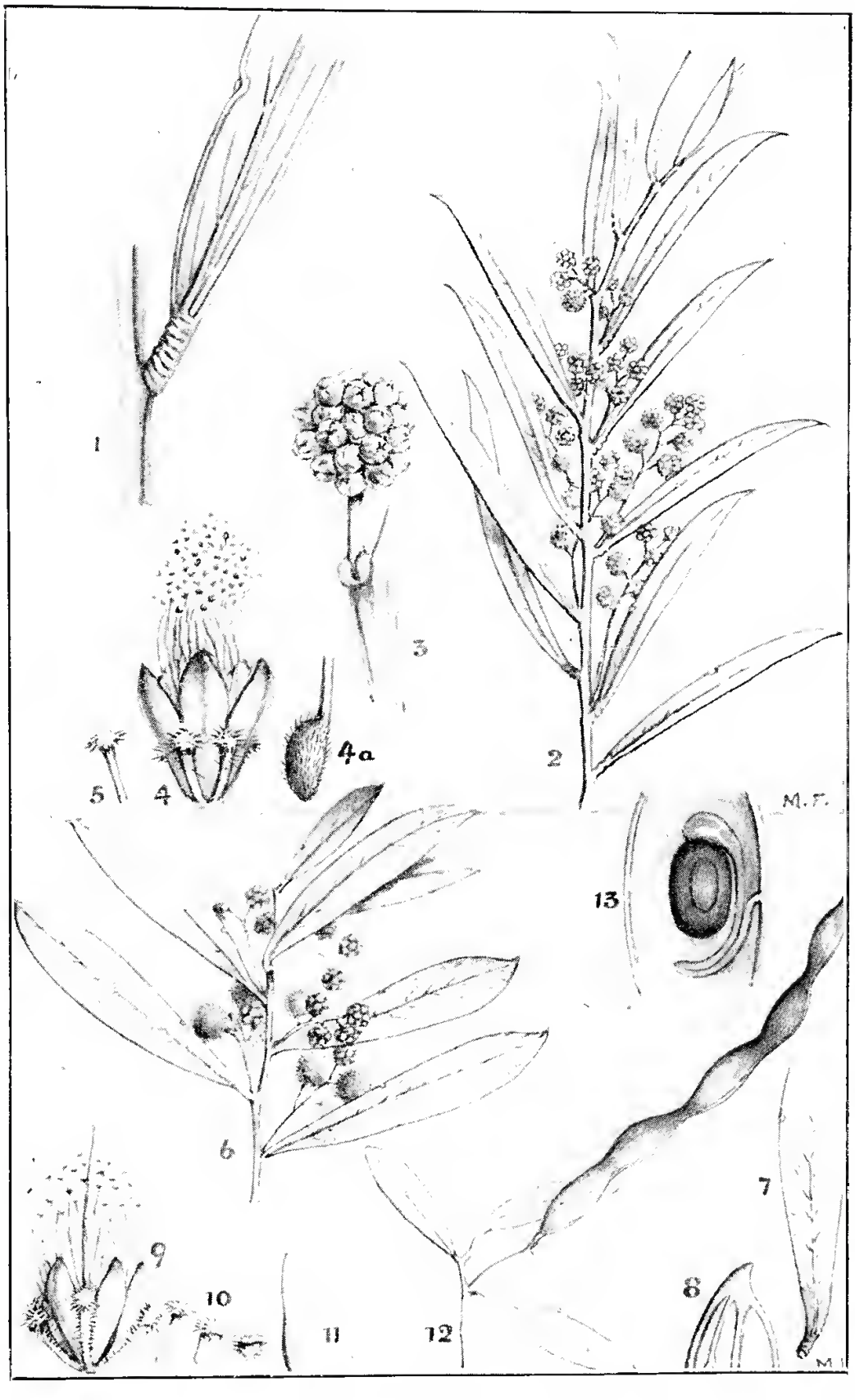




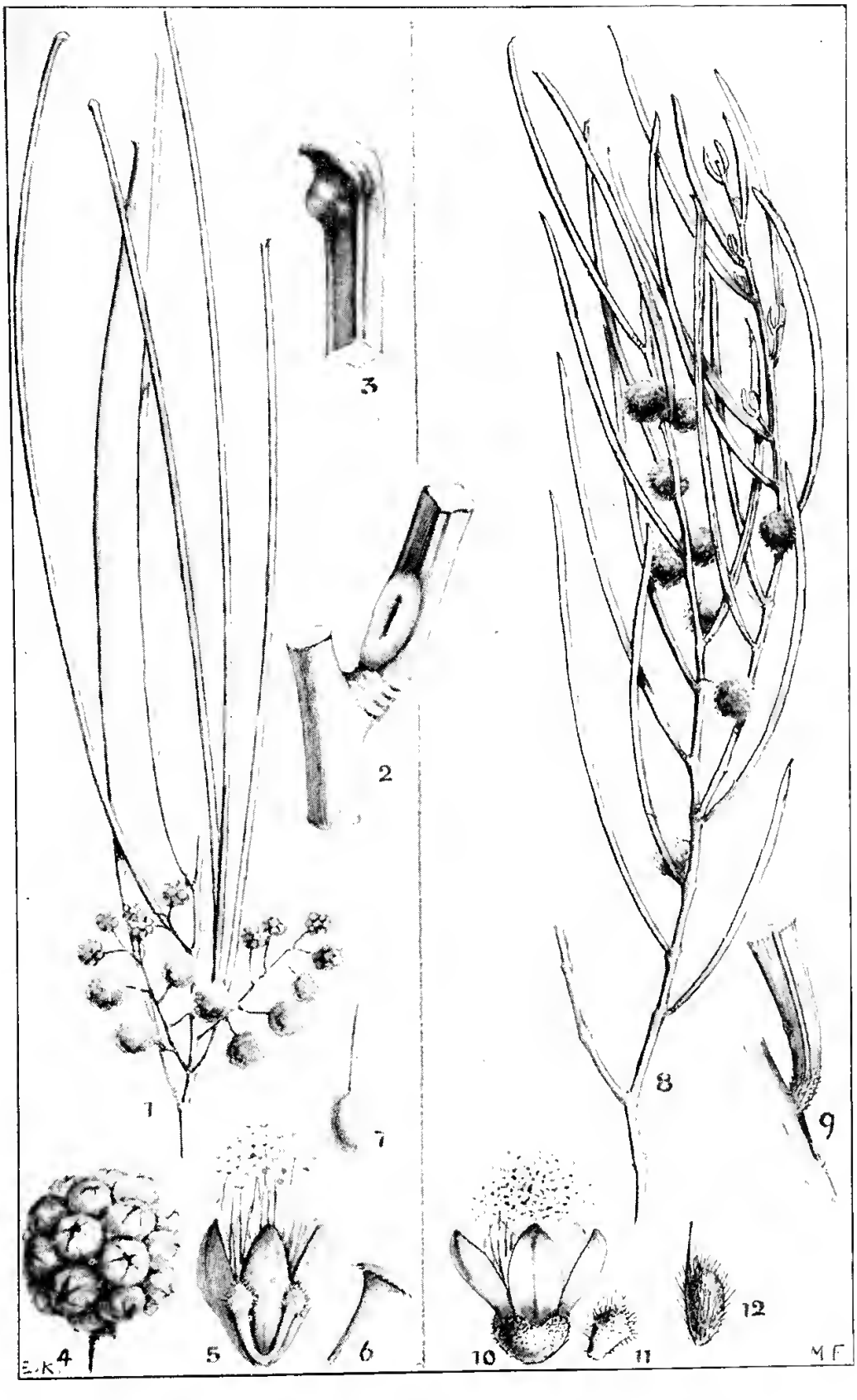
A. acutifolia n. sp. (1-4). *A. validinervia* n. sp. (5-8).



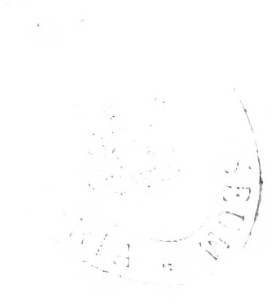
A. chrysella n. sp. (1-7). *A. Steedmani* n. sp. (8-14).

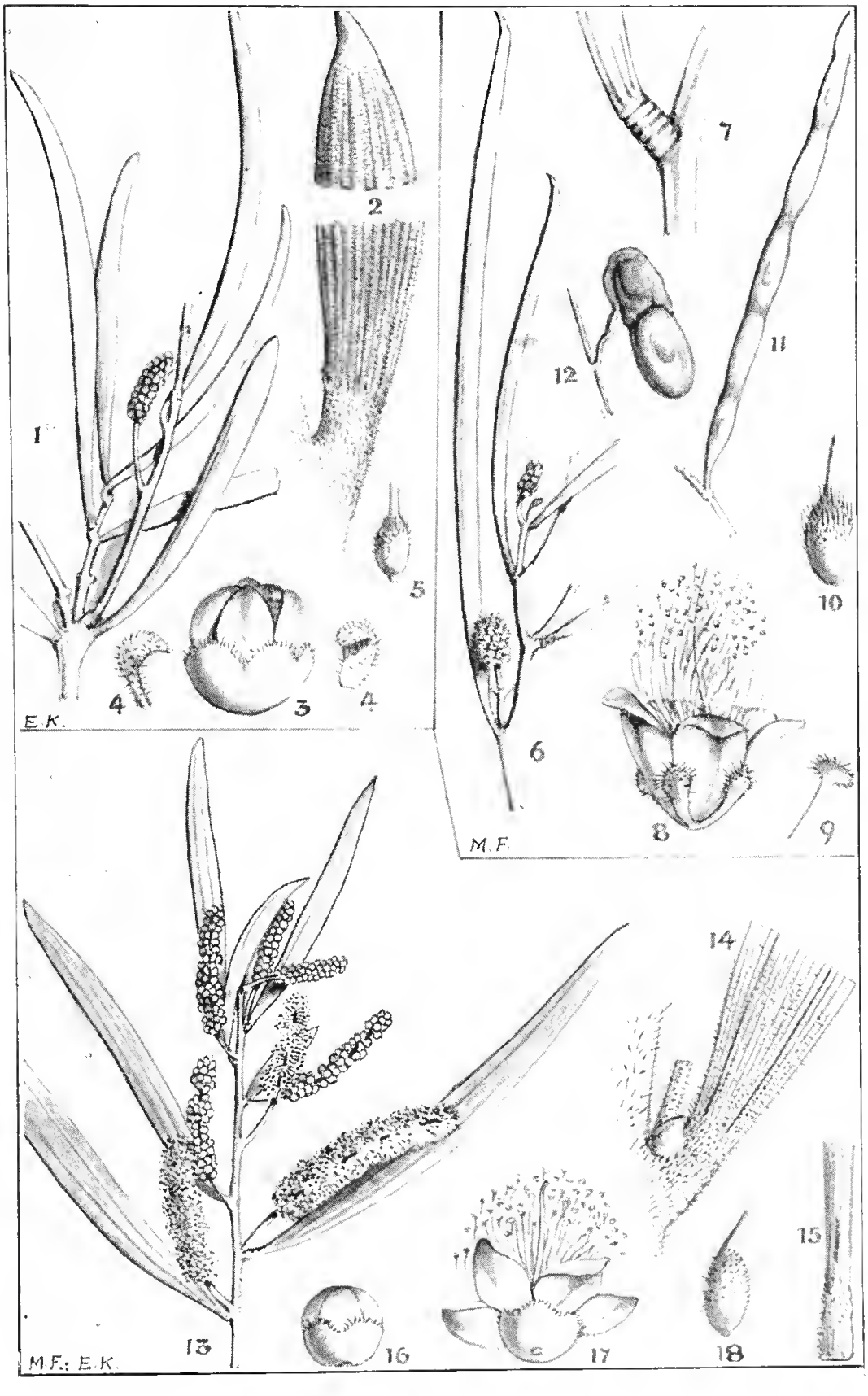


A. subglauca n. sp. var. *angustiuscula* n. var. (1-5). *A. subglauca* n. sp. (6-13).

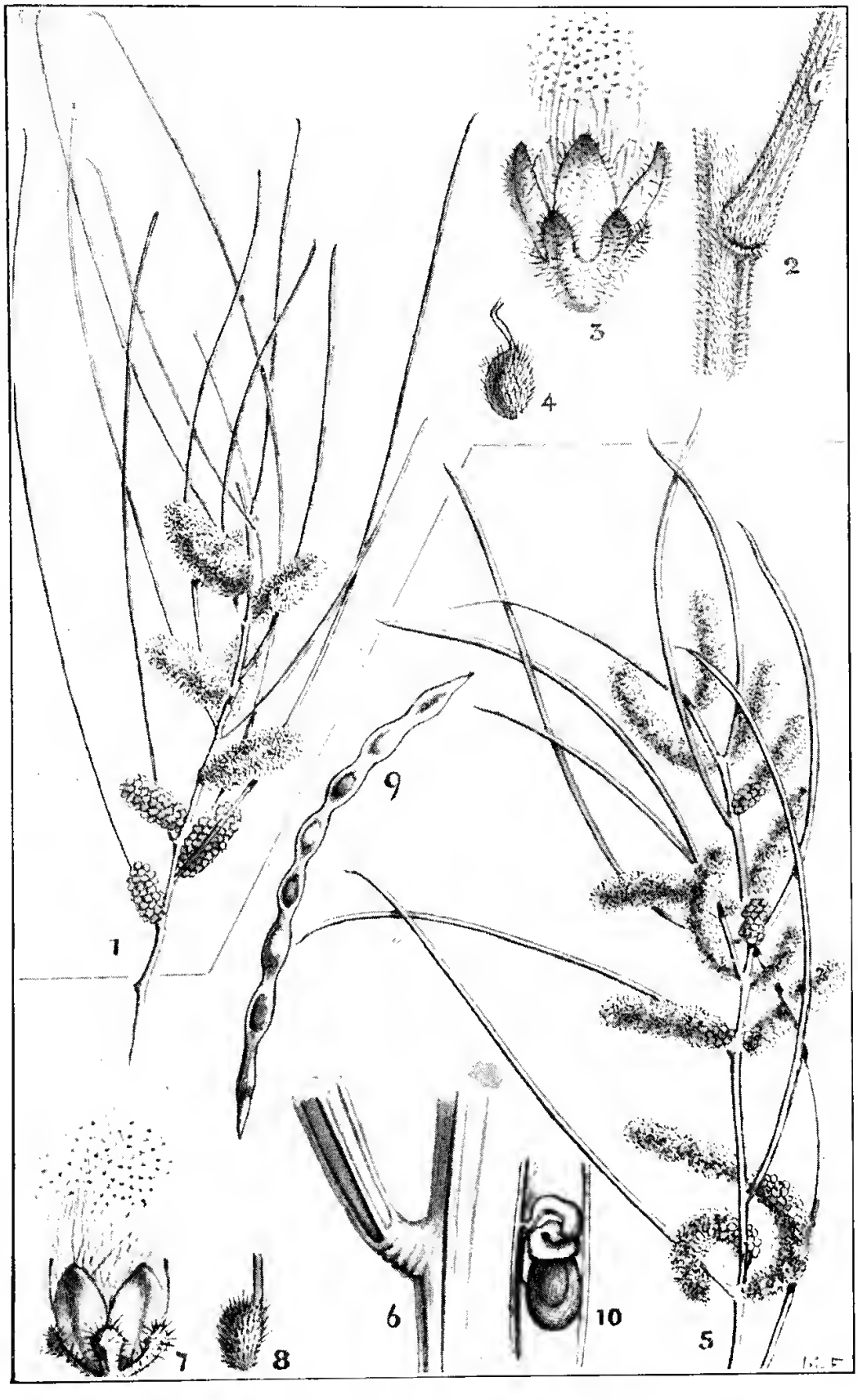


A. pachyacra n. sp. (1-7). *A. subangularis* n. sp. (8-12).

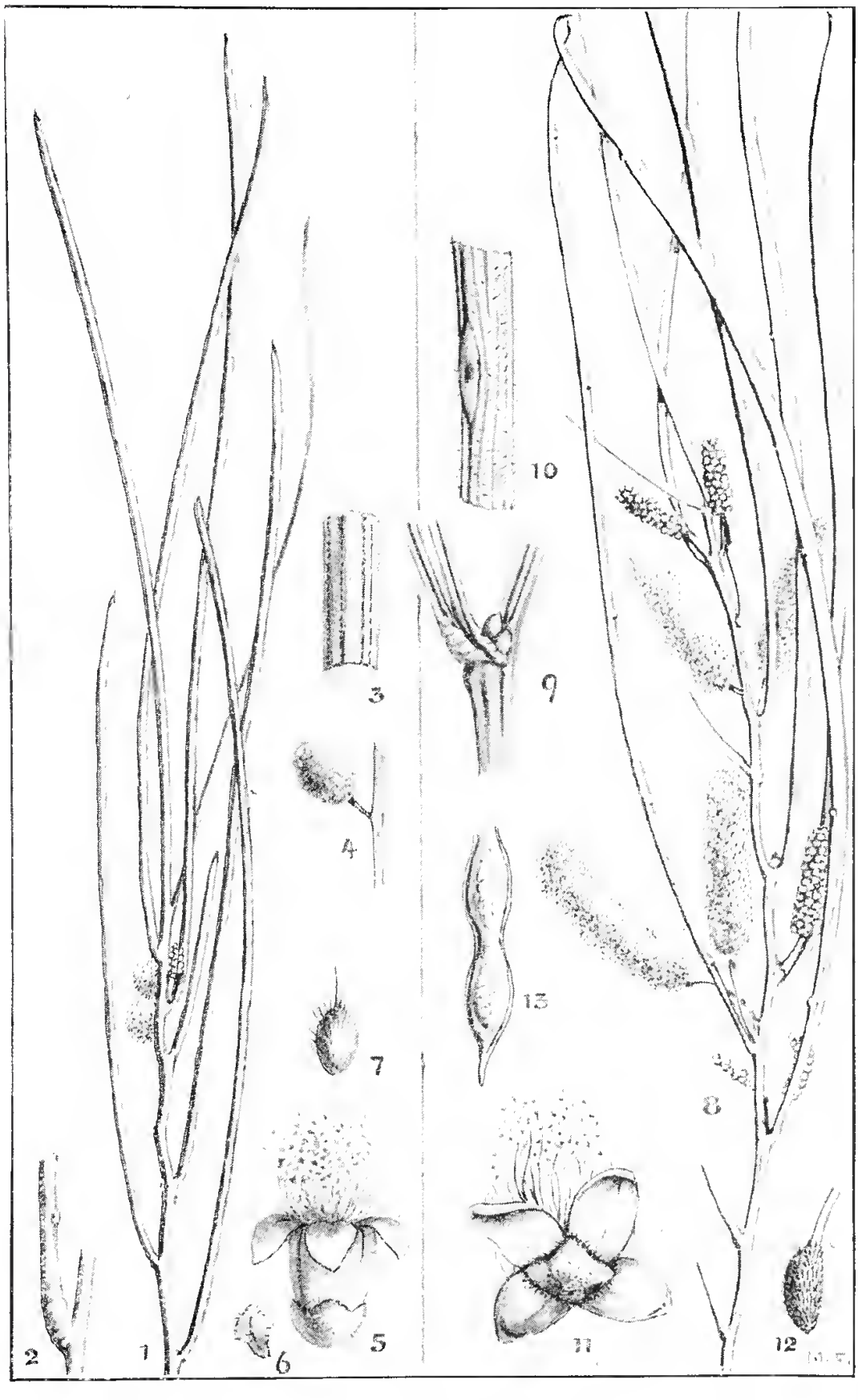




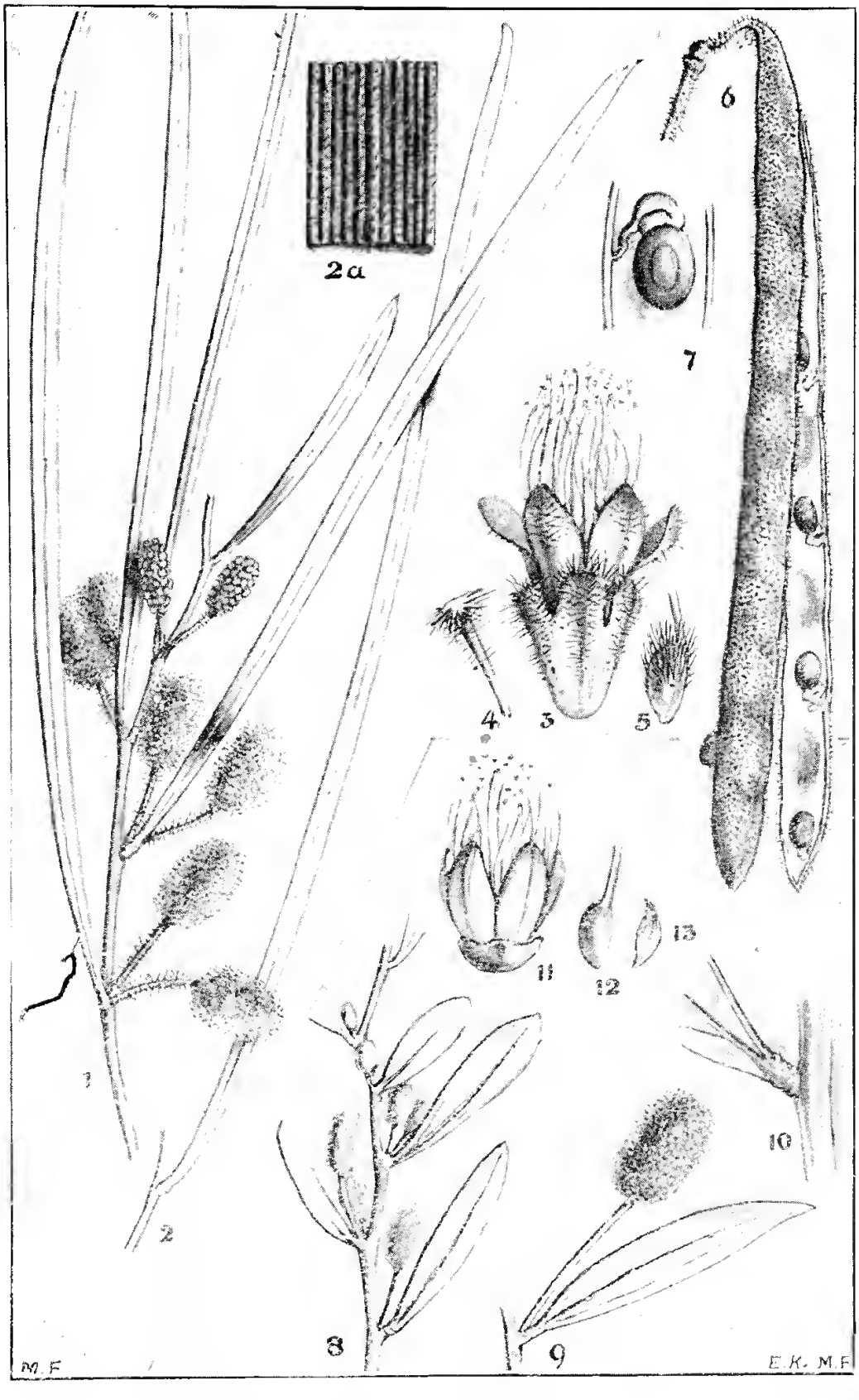
A. malloclada n. sp. (1-5). *A. Websteri* n. sp. (6-12). *A. sphaerogemma* n. sp. (13-18).



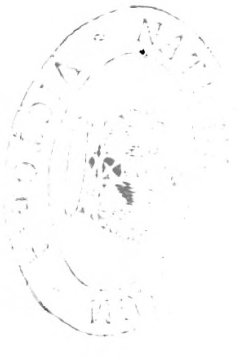
A. inophloia n. sp. (1-4). *A. sessilispica* n. sp. (5-10).

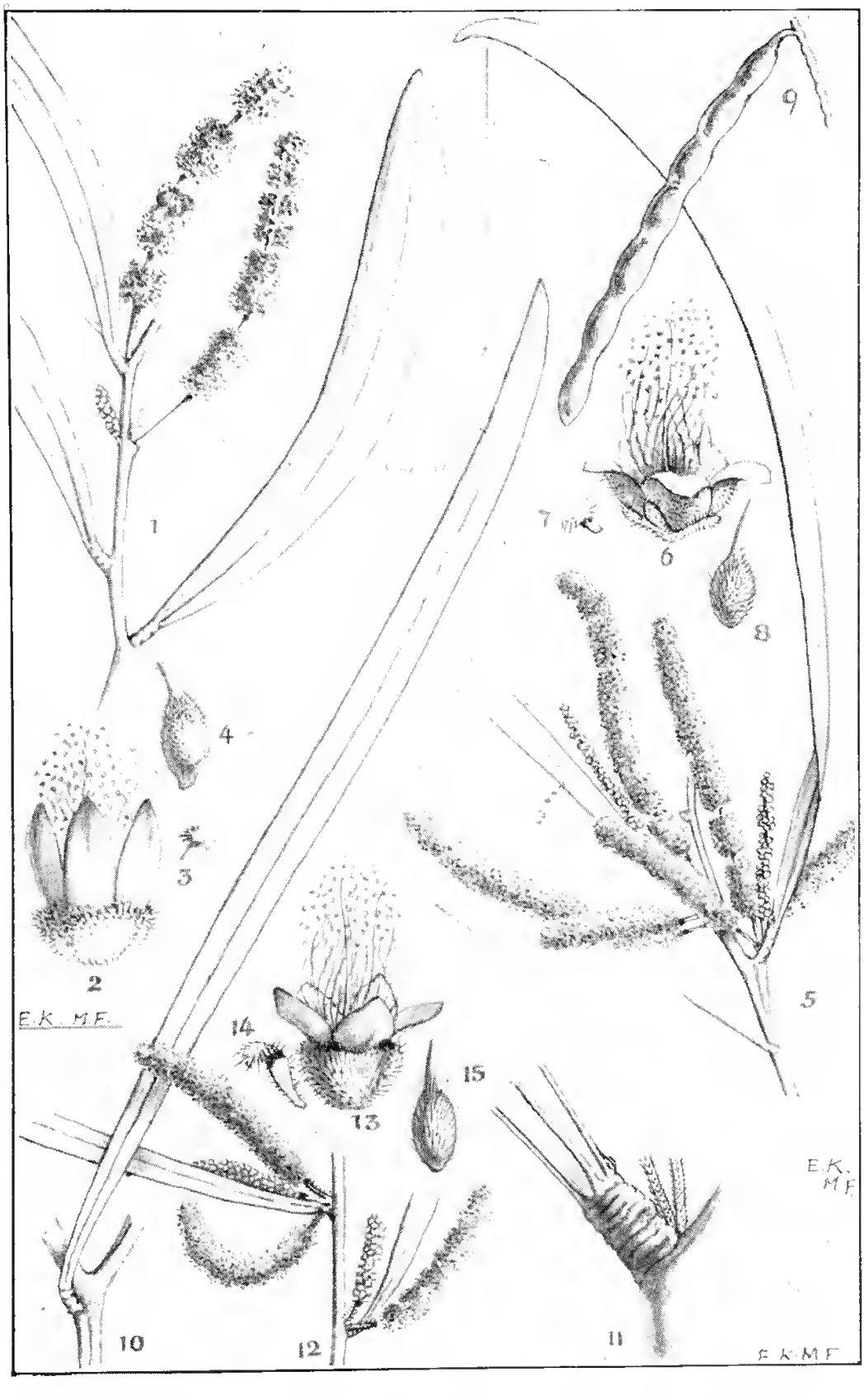


A. desertorum n. sp. (1-7). *A. Jibberdingensis* n. sp. (8-13).

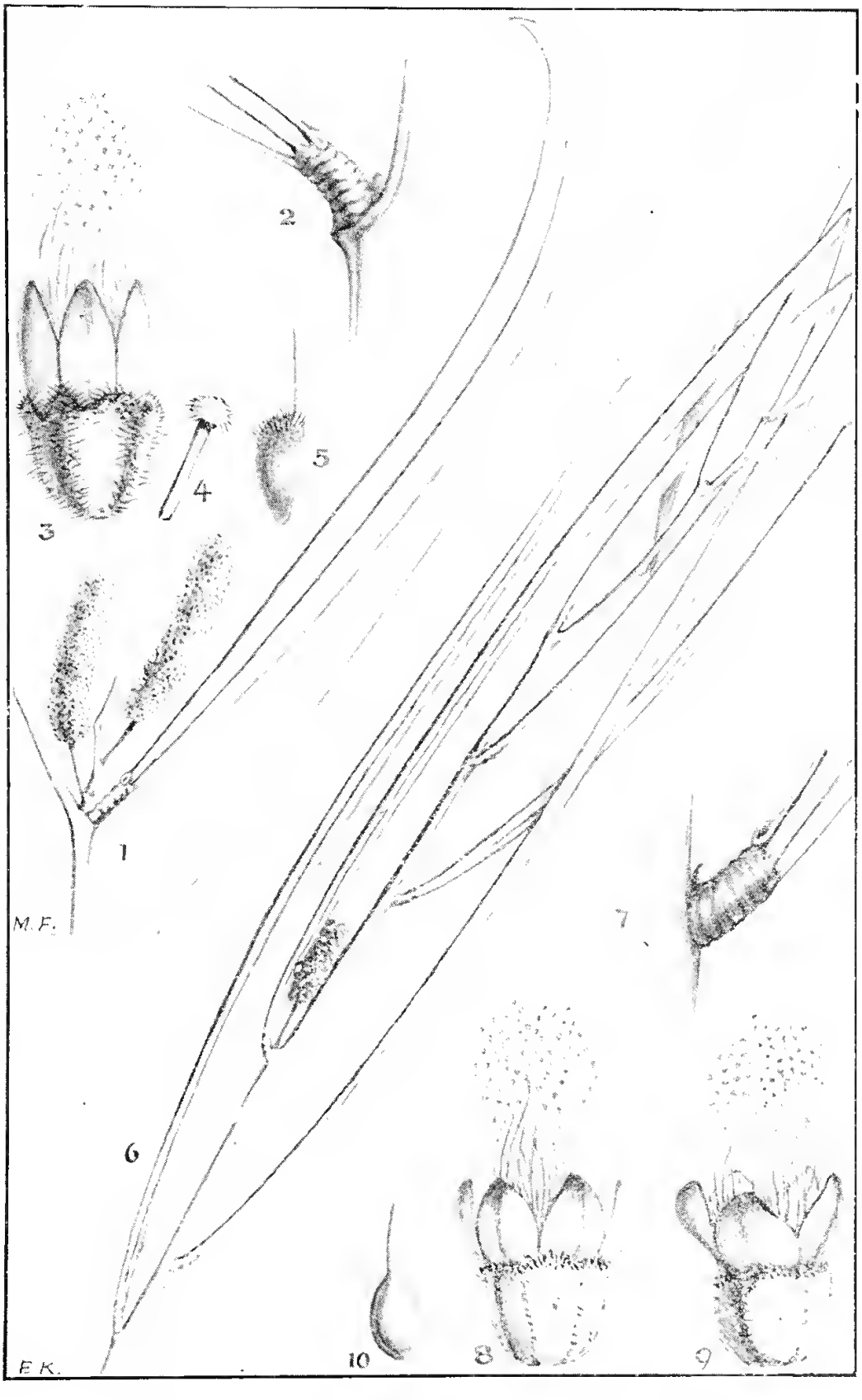


A. Fauntleroyi n. sp. (1-7). *A. glabripes* n. sp. (8-13).

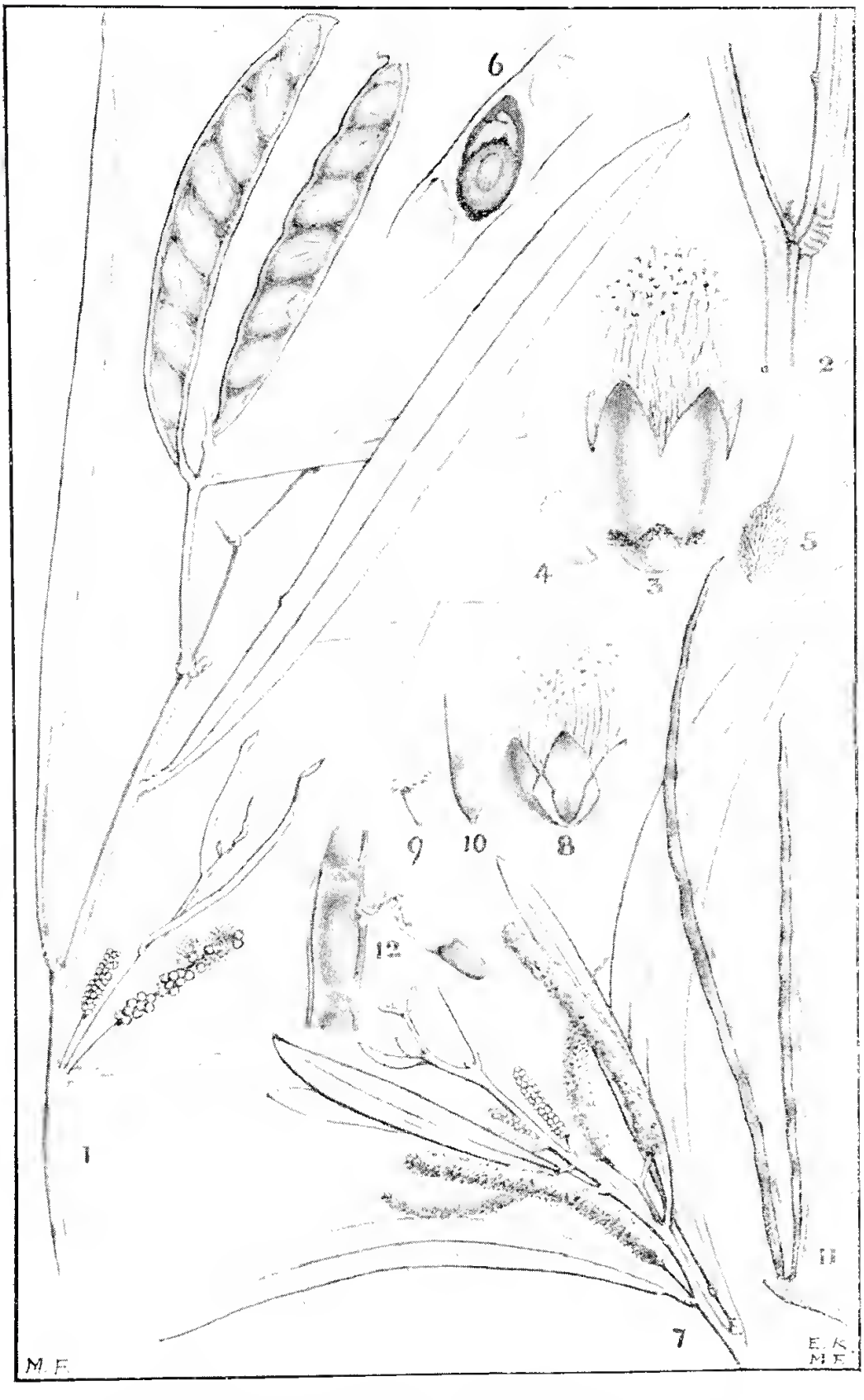




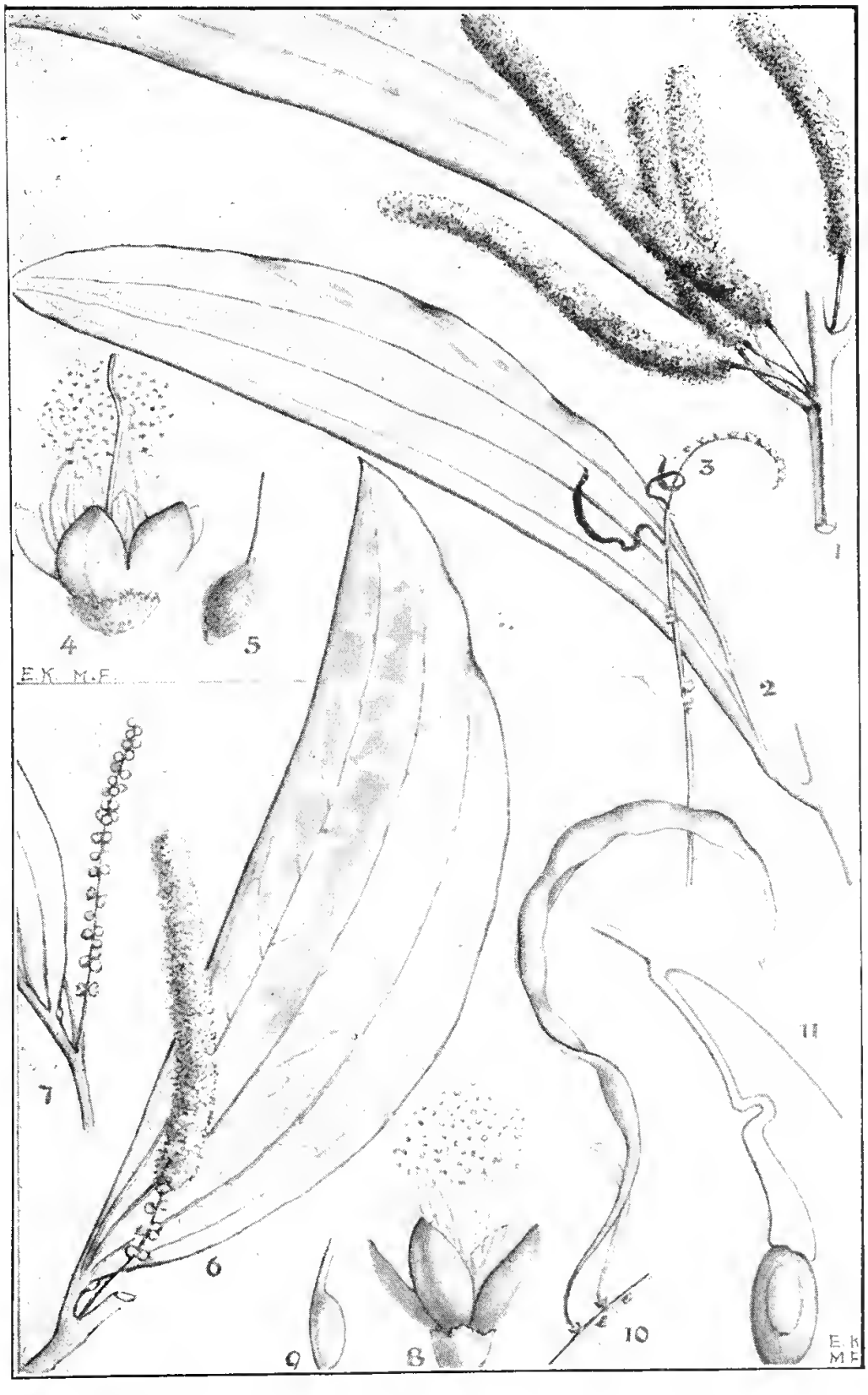
A. Clementi n. sp. (1-4). *A. numerosa* n. sp. (5-9). *A. criopoda* n. sp. (10-15).



A. cognata n. sp. (1-5). *A. adsurgens* n. sp. (6-10).



A. ancistrocarpa n. sp. (1-6). *A. lentiginea* n. sp. (7-10).
A. Jutsoni Maiden (11-12).



A. Cunninghamii Hook, var. *tropica* n. var. (1-5). *A. Gardneri* n. sp. (6-11).

2.—CONTRIBUTIONS TO THE MINERALOGY OF WESTERN AUSTRALIA

(With One Plate, xxiii., and Three Figures.)

By

EDWARD S. SIMPSON, D.Sc., B.E., A.A.C.I.

Series II.

(Read 14th June, 1927. Published 24th October, 1927.)

CONTENTS.

(1.) HYDROTHORITE (Sp. nov.), WODGINA, N.W. DIV.

Some years ago the author described a series of three radioactive minerals found in the tantalite-bearing pegmatite vein on M.Ls. 86 and 87 at Wodgina* (Lat. 21° 12′, Long. 118° 38′). These minerals were all hydrous silicates of thorium, uranium and lead, and were so related that two of them appeared to have been derived by weathering from the third, Mackintoshite, which was thought to be a primary constituent of the pegmatite. A fourth mineral in the series has now been detected, and this the author proposes to name Hydrothorite. The compositions and relationships of these minerals are—

(1.) Mackintoshite : $3ThO_2.4UO_2.PbO.CaO.8SiO_2.24H_2O$.
(2.) Thorogummite : $3ThO_2.4UO_3.PbO.CaO.8SiO_2.21H_2O$.
(3.) Pilbarite : $ThO_2.UO_3.PbO.2SiO_2.4H_2O$.
(4.) Hydrothorite : $ThO_2.SiO_2.4H_2O$.

During 1926 the tantalite vein on M.L. 86 was reopened in search of further tantalite by an adit at a depth of about 25ft. In this adit all the above minerals were encountered, the last named in greatest abundance and in masses up to 7 cm. (3in.) in diameter. It was associated with albite (more or less weathered), quartz, spessartite, manganotantalite and weathered lithiophilite.

The visible and easily determined distinctions between the four related minerals are—

	Mackintoshite	Thorogummite	Pilbarite	Hydrothorite
Texture	Glassy	Subvitreous, dense.	Earthy, porous, mod. tough	Earthy, very porous, fragile.
Hardness ...	4	3·5	3–2·5	1–2
Colour in mass ...	Black	Bright yellow	Orange	Pale pink or cream
Density	4·31–4·45	4·13	4·68	?
Light refraction	Isotropic n, ?	Isotropic n, 1·617†	Isotropic n, 1·74	Isotropic n, 1·638‡

* Geol. Surv. W.A. Bull. 48, pp. 9–21.
† Mean value. It ranges from 1·609 to 1 624. varying with hydration.
‡ Determined on the powder which was analysed.

No traces of crystalline structure have been observed on any of the minerals, except in rare doubtful cases on Pilbarite. All four prove to be highly radio-active when examined with a scintilloscope.

A nodule of hydrothorite of uniform colour and appearance and weighing about 6 grammes was taken for analysis. Attempts to determine its density failed owing to the rapidity with which it broke off in small flakes immediately it was immersed in distilled water, the result apparently of rapid imbibition. The colour of the mineral when dry was Ridgway 18″f, *i.e.*, between "pale pinkish buff" and "cartridge buff." This colour was considerably altered by wetting, the wet mineral matching Ridgway 15f, "pale yellow orange." In mass it was opaque, but under a microscope the fine powder was transparent and isotropic.

The thoroughly air-dried mineral was readily powdered in an agate mortar, to which it showed a strong tendency to adhere, as well as giving a sticky resinous feel between the fingers.

The results of the analysis made * are given in the following table alongside those of the type minerals which most nearly approach it in composition, viz., Thorite, Orangite, and Uranothorite, the last two being simply varieties of the first.

Type mineral ...	Thorite.	Orangite.	Uranothorite.	Hydrothorite.
Locality ...	Lovo, Norway.	Brevik, Norway.	L. Champlain, U.S.A.	Wodgina, W.A.
SiO_2	18·98	17·52	19·38	15·77
ThO_2	57·91	71·65	52·07	57·79
Ce_2O_3	...	...	...	·24
Y_2O_3	...	...	...	·73
UO_2	1·62	*Nil*	*Nil*	*Nil*
UO_3	...	1·20	9·96	2·98
Fe_2O_3	3·40	·31	4·01	*Nil*
Mn_2O_3	2·39	·28	...	trace
Al_2O_3	·06	·17	·33	·88
PbO	·80	·88	·40	1·25
CaO	2·58	1·59	2·34	1·65
MgO	·36	...	·04	·60
K_2O	·14	·14	·11	*Nil*
Na_2O	·09	·33	...	*Nil*
H_2O	9·50	6·14	11·31	15·18
CO_2	...	...	...	1·50
P_2O_5	...	...	...	1·33
Insol.	1·70	...	...	*Nil*
	99·53	100·14	99·95	99·90
Density ...	4·8	5·19	4·13	?
Ref. index	1·686	1·693	?	1·638

The analysis and microscopic examination of the analysed material indicate that about 90 per cent. of it consists of a light amber coloured and transparent (under the microscope), isotropic, probably amorphous, substance with a refractive index of 1.638, and a composition expressed by the formula $ThSiO_4 . 4H_2O$. This substance differs from typical thorite and its varieties by the much higher water content and lower refractive index. It is worthy of specific rank under the name Hydrothorite.

Intimately admixed with it in small quantities are a carbonate, a phosphate, and probably a second silicate. Attempts to determine these specifically were not successful, but there are reasons for believing they include

* Only vessels of quartz and platinum were used. Except where otherwise stated all analyses of W.A. minerals in this paper were made by the Author.

dolomite, kaolin and autunite. Auerlite, an ill-defined and doubtfully homogeneous mineral from North Carolina, is thought to be a compound silico-phosphate of thorium. Possibly some of the phosphorus of the Wodgina mineral is present in this form, or as one of the recently described lead uranium phosphates, parsonsite, dumontite or dewindtite.

The chemical properties determined are as follow:—Part of the water is very loosely held so that differences of about one per cent. in the total water are noted under different conditions of atmospheric temperature and humidity. Drying for two hours at 100° removes 9.12 per cent. of water. Of the remaining 6.06 per cent. about 5 per cent. is removed at 600° C., the balance at a bright red heat (about 800°).

The powdered mineral is freely attacked by warm and moderately strong mineral acids. The most rapid and complete attack is by warm 1OE, HNO_3, which leaves a granular residue consisting only of hydrous silica.

In nature the chemical change in Mackintoshite under weathering is first an oxidation of UO_2 to UO_3, then a progressive removal of lime, uranium, lead, silica and water, leaving ultimately a simple hydrous thorium silicate —Hydrothorite.

The type specimen is in the Western Australian Museum, and a co-type has been sent to the British Museum.

(2.) LITHIOPHILITE AND PURPURITE, WODGINA, N.W. DIV.

In Series 1 of these contributions the Author described a boulder of lithiophilite ($LiMnPO_4$) from a somewhat indefinite locality approximately 20 miles south-west of Wodgina. Further information regarding the find indicates that the more exact position is on Yandeyarra Station, a little south of Mt. Francisco. No further specimens have been obtained from this place.

Lithiophilite has now been found to be rather plentiful at Wodgina itself, many specimens in various stages of alteration having been obtained in Lewis' pegmatite vein, one mile north of the township, and in the manganotantalite bearing pegmatite on Mineral Lease 86, as well as in the adjacent detrital material. Lithiophilite weathers rather readily by loss of lithia, assumption of water and oxidation of FeO and MnO to Fe_2O_3 and Mn_2O_3 yielding Purpurite, $H_2O.(Mn,Fe)_2O_3.P_2O_5$. Still further alteration gives rise to Psilomelane and Limonite. These effects are observable in all stages at Wodgina, the mineral gradually darkening in colour from honey yellow, or pale grey, to brown, and finally black, the cleavages becoming more obscure, and the density falling through all stages from 3.4 to 2.8. The black stage is locally known as "Plumbite," a term of unknown origin, or as "Likem," because the detrital fragments are like in appearance to detrital manganotantalite, at present in commercial demand and keenly sought for.

The freshest lithiophilite so far found in the immediate vicinity of Wodgina is that occurring on Lewis' property, one mile west of the tantalite mine. The owner states that he has uncovered already one ton of the mineral in three seams in a pegmatite vein traversing greenstone schists of the Warrawoona Series (older Pre-Cambrian) and emanating probably from the adjacent Pre-Cambrian granite. An average sample of this ton contained—

Li_2O, 1.50 per cent.; P_2O_5, 35.03 per cent.; Insoluble, 3.38 per cent.

The low figure for lithia indicates extensive alteration.

The least altered fragment was selected for complete analysis. It belonged to a single crystal individual and showed two imperfect cleavages, one (001) better than the other (010). It was fairly tough with a hardness of 4½. The colour of the mass was mottled, owing to irregular oxidation, the colour varying from brownish black to dark red brown (1‴m to 1″m Ridgway) with minute areas much paler, about honey yellow.* The cleavages were continuous and not interrupted by the variations in colour. The colour of the powder was wood brown (17‴). Its density was 3.23.

After moistening with H_2SO_4 it gave a strong lithium flame, but did not etch glass, thus differing from triplite, $MnF.MnPO_4$. By a rigid analytical method Mr. D. G. Murray, of the Government Laboratory, has proved the absence of fluorine from the Wodgina mineral. The mineral in powder dissolved readily in warm strong HCl with evolution of some chlorine. It was much less soluble in other acids than the quite unweathered lithiophilite from Yandeyarra, being only very slowly attacked by hot dilute (5E)H_2SO_4, except in the presence of a reducing agent such as H_2SO_3 or $FeSO_4$. It dissolved slowly in hot dilute (5E)HNO_3 leaving a slight dark brown residue, apparently an MnO_2 compound.

The results of the analysis are given in the table below in column A, those in column B being recalculated after deducting moisture and insoluble in acids, mainly quartz. In column C are given the theoretical figures for lithiophilite, and in column D those for purpurite, in both cases the ratio of iron to manganese found in the Wodgina mineral being maintained.

	A. Altered lithiophilite Wodgina.	B.	C. Theory Lithiophilite.	D. Theory Purpurite.
P_2O_5	42·77	42·98	45·23	44·65
FeO	4·23	4·25	7·07	...
Fe_2O_3	2·50	2·51	...	7·75
MnO	22·77	22·88	38·19	...
Mn_2O_3	13·38	13·44	...	41·94
Co_2O_3	·10	·10	...	...
CaO	3·30	3·32	...	...
MgO	·84	·84	...	...
Li_2O	4·48	4·50	9·51	...
Na_2O	·15	·15	...	...
K_2O	·05	·05	...	...
F	*Nil*	*Nil*	...	...
H_2O+	5·62	5·65	...	5·66
H_2O-	·06	...	...	...
Insoluble... ...	·42	...	...	...
	100·67	100·67	100·00	100·00
D.	3·23	3·24	3·45	3·10±

The figures for the relative states of oxidation of the manganese and iron are not exact owing to imperfections in analytical methods. Practically the whole of the water is removed at about 550° and fusion takes place at about 800°.

* Later specimens received from Wodgina consist of a somewhat less altered lithiophilite. One from the tantalite vein on M.L. 86 has a density of 3·36 and one from Lewis' vein a density of 3·28. Both show large cores, up to 5 mm. diameter of dull, yellow lithiophilite shading off through amber brown to brownish black.

It would appear then that this material from Wodgina is not homogeneous but consists of lithiophilite, partly (about one-third) altered by weathering into pseudomorphous purpurite, the alteration spreading inwards from the most prominent cleavage planes in accordance with the following equation—

$$Li_2O.2MnO.P_2O_5 + 2H_2O + 2CO_2 + O = H_2O.Mn_2O_3.P_2O_5 + 2LiHCO_3.$$

This is the first record of the occurrence of Purpurite in Australia.

The only associated minerals recorded from Lewis' vein so far are albite, microcline, apatite, spessartite, and quartz. On the tantalite mine the following have been noted in contact with it: Albite, quartz, muscovite, spessartite, manganotantalite, hydrothorite, thorogummite, apatite and autunite.

(3.) AUTUNITE, WODGINA, N.W. DIV.

Included in a fine suite of specimens recently brought to Perth by Mr. G. Skuthorpe from the Tantalite Mine (M.L. 86), at Wodgina, were some showing lithiophilite and thorogummite in juxtaposition. On some of the contacts, and in cracks in both minerals near their junction, thin crusts were observed of a finely scaly, soft mineral, varying in colour from Ridgways 25d to 31d (pale greenish yellow to light yellow green). The general appearance and association with a phosphate (lithiophilite) and a uranium mineral (thorogummite) suggested autunite ($CaO.2UO_3.P_2O_5.8H_2O$). Optical tests confirmed this surmise, the bi-refringence of the flat scales being very small, and the mean refractive index being determined by immersion as 1.575. The recorded data for the optical properties of a basal section of autunite are Nm, 1.575; Ng, 1.577; Y = b, Z = a.

This is the first time that autunite has been discovered in Western Australia.

(4.) SPESSARTITE, WODGINA, N.W. DIV.

Crystals and fractured fragments of a pale coloured garnet have been found for some time past in the alluvial gravels carrying cassiterite and manganotantalite at Wodgina. Recently the same mineral has been found *in situ* in the tantalite lode (an albite pegmatite vein) on M.Ls. 86 and 87. In the latter it appears as very pale pink to light brownish red crystals. The best specimens, however, have come from adjacent soil and gravels. These latter are crystals or fragments up to about 3cm. in diameter. The common form is the dodecahedron (110) bevelled by a trapezohedron (211). Comparatively rare are crystals of the trapezohedron (211) with faint truncating of the solid angles by the dodecahedron (110). The translucency varies in different crystals from a limiting thickness of 1 mm. to one of 5 mm.* The colour is difficult to match with Ridgways standards, but for the most part lies approximately between 15″ and 15″d (cinnamon to light pinkish cinnamon). Most noticeable is the very thin, almost pure black coating of psilomelane, which completely covers a few of the detrital crystals.

A typical detrital specimen of a little over 6 grammes in weight, and having a density of 4.16, was analysed with the following results—

	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	Total
Per cent. ...	36·03	·03	20·84	traces	4·18	37·79	·81	·19	99·87
Mols.	6,001	4	2,044	...	582	5,327	145	47	...

from which the ratios $MO:M_2O_3:SiO_2$ are calculated to be 3.01:1.01:2.97.

Microscopic crystals of spessartite have previously been detected in a schist from the Eyre Range. S.W. Div.

* Maximum thickness permitting a perceptible amount of daylight to pass through.

(5.) PILOLITE, WADARA HILLS, N.W. DIV.

According to Doelter*, who gives the latest and most complete account of the Palygorskite group of minerals, this group comprises most of the so-called "mineral leather" and "mineral cork" (mountain cork) which he divides between four mineral species, viz., Palygorskite alpha and beta, and Pilolite alpha and beta. The four minerals he considers are formed of isomorphous associations in four different proportions of the compounds $2H_2O.2MgO.3SiO_2 + 2H_2O$ and $3H_2O.Al_2O_3.4SiO_2 + 2H_2O$. In this series the palygorskites are at the more aluminous end, the pilolites at the more magnesian end. Further reference to the constitution of the members of the group will be made after considering the local mineral.

In sinking a well on Pastoral Lease 3367/97, between the Wadara Hills and the Rabbit Proof Fence (Lat. 23° 0′ S., Long. 121° 3′ E.) masses of almost pure white spongy material were found at a depth of about 70 feet in sediments including sandstones, clays, and travertine with common opal. One of the spongy masses was examined in the Government Laboratory and was found to approximate to Doelter's alpha-pilolite.

It was a subrounded mass about 8 x 4 x 3 inches (20 x 10 x 7.5 cm.) in size, very light and porous in texture, and quite tough, breaking and cutting like cork. For the most part it was pure white in colour, but slight stains of limonite and psilomelane occurred in places.

For analysis, some of the whitest material was coarsely crushed, and washed well with distilled water to remove associated traces of salt and epsomite, then air-dried till constant in weight, and ground fine. The analytical results are given below with comparative figures for similar minerals from Scotland, Chile and New Mexico—

——	Beta Palygorskite Scotland.	Alpha Pilolite Chile.	Alpha Pilolite New Mexico.	Pilolite Wadara Hills.	Pilolite Wadara Hills.
	%	%	%	%	mols.
SiO_2 ...	54·37	54·72	60·97	55·12	917
Al_2O_3 ...	11·27	7·95	9·71	9·67	95
Fe_2O_3 ...	·21	2·22		1·25	8
FeO ...	1·09	·92	...	...	...
MnO ...	·33	·43	...	trace	...
MgO ...	9·49	11·81	10·00	10·55	261
CaO ...	·98	·02	·22	*Nil*	...
$H_2O + 100°$	13·15	6·81	19·14	13·14	729
$H_2O - 100°$	9·26	15·12		10·48	582
	100·15	100·00	100·04	100·21	

Almost the whole of the combined water was driven off by two hours' heating at about 550°C.

The mineral selected for analysis was examined under the microscope and found to be practically uniform, at least 99 per cent. being apparently uniaxial with a low birefringence, and No equal to 1.512. The other 1 per cent. was finely scaly with higher birefringence, possibly kaolinite. The hardness of the analysed material was about 1.5 and the true density, determined with methylene iodide, was 2.10. The microscopic structure was elongated scaly rather than filamentous, as described for many minerals of this group. The scales were somewhat wrinkled and twisted, which accounts for the appreciable toughness of the mineral in mass.

* Handb. der Mineralchemie, 11 (2) 670.

Having analysed the mineral, consideration was given to Doelter's theory of its constitution, as well as to that of Lacroix, which is almost identical.* Both consider the series to consist of isomorphous intergrowths of two end members as follow:—

Doelter.	Lacroix.
$3H_2O.Al_2O_3.4SiO_2 + 2H_2O$	$H_2O.Al_2O_3.4SiO_2 + 5H_2O.$
$2H_2O.2MgO.3SiO_2 + 2H_2O$	$4H_2O.2MgO.3SiO_2.$

Our present knowledge of isomorphous displacements makes it certain that neither of these suggested pairs could have such identical space lattices as to enable them to displace one another in such varied proportions as are needed to conform with the published analyses of minerals of the series. To do this there must be (with certain rare exceptions not involved here) an identical number of elements in each space lattice, which demands † an identical number of atoms in each solid molecule, a condition very far from being satisfied by either of these suggestions.

The author has found that by taking the halloysite molecule as a basis, and deriving therefrom a corresponding isomorphous magnesium silicate (conveniently called here picrocollite) by substituting MgSi for Al_2, a series can be built up corresponding very closely to most of the published analyses of palygorskite and pilolite. The two primary molecules are—

Halloysite	$H_4Al_2Si_2O_9 + 2H_2O$ = (Hal).	
Picrocollite	$H_4MgSi_3O_9 + 2H_2O$ = (Hmg).	
Alpha-palygorskite is then ...	Hal + Hmg	$(MgO \cdot Al_2O_3 \cdot 5SiO_2 \cdot 8H_2O)$.
Beta-palygorskite	Hal + 2Hmg	$(2MgO \cdot Al_2O_3 \cdot 8SiO_2 \cdot 12H_2O)$.
Wadara Hills pilolite close to ...	Hal + 3Hmg	$(3MgO \cdot Al_2O_3 \cdot 11SiO_2 \cdot 16H_2O)$.
Alpha pilolite	Hal + 4Hmg	$(4MgO \cdot Al_2O_3 \cdot 14SiO_2 \cdot 20H_2O)$.

The formula recently ascribed by Ross and Shannon‡ to montmorillonite (the chief constituent of most bentonite) is $MgO.Al_2O_3.5SiO_2nH_2O$, which is exactly Hal + Hmg. There is therefore probably a close relationship in constitution betwen palygorskite and montmorillonite, though their state of aggregation appears at first sight so dissimilar.

This is the first record of the occurrence of this group in Western Australia. W. F. Petterd recorded the presence of pilolite at Mt. Bischoff, Tasmania, in 1910. H. Y. L. Brown in 1908 noted the occurrence of "mountain cork" at Sailors' Gully near Gawler, South Australia; whilst as long ago as 1867 an Intercolonial Exhibition pamphlet referred to "mountain leather" at Tarilta, Victoria. No analyses of any of these can be found.

(6.) LEPIDOLITE (UNIAXIAL AND BIAXIAL) AND MUSCOVITE, LONDONDERRY, CEN. DIV.

In the annual report of the Geological Survey for 1897, T. Blatchford and the Author made the first record of the occurrence of lepidolite in large "books" in a pegmatite vein four miles N.W. of Londonderry. This is in an area sometimes referred to as Grosmont, from the name of an adjacent gold mine (Lat. 31° 5′, Long. 121° 7′). Subsequently in 1902 the author published an analysis of the mica.§ Some details of its occurrence were given by T. Blatchford in 1913.‖ Later a second analysis was made by the author but not published: the figures were, however, communicated to A. N. Winchell and used in his "Studies in the Mica Group."¶ Altogether some tons

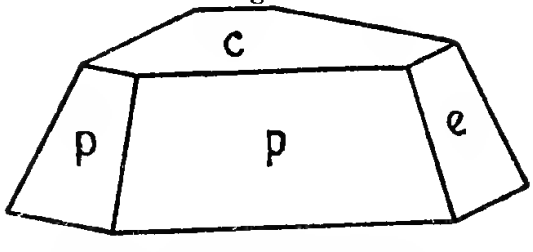
* Min. de la France, IV., 745.
‡ our. Amer. Cer. Soc. IX., 77–96 (1926).
‖ G.S.W.A., Bull. 53, p. 19.
† As recognised long ago by Tschermach.
§ G.S.W.A., Bull. 6, p. 57.
¶ Am. J. Sci. 9 (1925), p. 424, 427.

of this mica were quarried, and marketed, most of it being trimmed into rectangular sheets at the mine. Owing to its low fusibility it was ultimately found inadvisable to use the mica as a substitute for muscovite for many purposes, and no demand for it as a source of lithia has ever arisen.

The mica referred to above had several peculiarities as compared with ordinary lepidolite. In the first place it occurred in large crystals or "books," yielding clear, homogeneous basal flakes as large as 40 x 30 cm. (15 x 12 inches), though the average was less, say, 10 cm. square. Secondly, it was optically uniaxial, though all other recorded lepidolites, with the exception of one from Mursinsk, are biaxial, with optic axial angles (2E) ranging from 21° (Elba, Comucci) to 76° (several localities). Finally, it was richer in lithia, 5.83 to 6.15 per cent., than any previously described lepidolite.

Several imperfect crystals of this uniaxial mineral have been observed. One has a hexagonal base, three alternate arrises of which are about half the length of the other three, the diameter being 5 cm. The two basal faces are connected by six rather rough and horizontally striated pyramid faces which (assuming the data for muscovite to apply to lepidolite) are p^1 p^2 p^3 p^4 e^1 e^2, p being (113), and e (023). *See* Fig. 1. The striations

Fig. 1.



Crystal of Uniaxial Lepidolite, Londonderry.

are due to narrow alternating faces of other steeper pyramids probably (111) and (011). Only approximate angle measurements were possible and these agreed with the figures calculated for muscovite, viz., cp, 66½°; ee, 66½°. In other specimens a gliding plane is prominent which approximates to (—205) of muscovite, in one case it is associated with a pressure figure of the typical three-rayed form, one ray parallel to the gliding plane. The hardness of the mineral is 2.5, and its density 2.84. Its colour in thick blocks is maroon or madder brown. In flakes 1 mm. thick it is perfectly transparent with a slight purplish brown tint. Optically it is uniaxial, negative, with Ng = Nm = 1.5550, Np = 1.5324 for sodium light as determined by A. N. Winchell (*loc. cit.*).

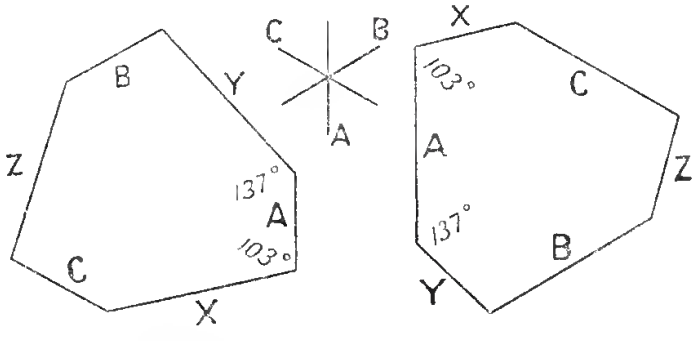
Two analyses of this uniaxial mica made at intervals of many years are given in the table below. A determination of the alkalis in a third specimen on another occasion gave Li_2O, 6.15; Na_2O, 0.52; K_2O, 11.12 per cent. The average lithia content in lepidolites from 16 different localities (including five in Western Australia) is only 4.23, the previous highest recorded being 5.88 in a single specimen from Rozena, Moravia. As in the latter, the fluorine is unusually high in the Londonderry mineral.

The etching figures, obtained by treatment of the basal plane with hydrofluoric acid, emphasise the hemimorphic structure suggested by the single crystal examined. Two forms of pittings—which are reflections of one another over a vertical plane making an angle of approximately 22° 30′ with (010) and possibly symbolised by (150) or (290)—are distributed indiscriminately over a single surface. Their forms and relationships to the percussion figure are shown in Fig. 2. A single similar form has been described

by H. Baumhauer* as developed by him on the variety of dark brown lepidolite from Mursinsk which has a very small optic axial angle.

Dr. C. O. G. Larcombe and Mr. D. McDougall, of the Kalgoorlie School of Mines, drew my attention to the fact that there was a second variety of lepidolite in the Grosmont quarry, characterised by a large optic axial angle. The latter supplied me with a few specimens of it and informed me that it occurred only in the footwall section of the pegmatite vein close to a narrow vein of topaz, whilst the uniaxial mica is found in the hanging wall section. Both are associated with very coarse microcline-perthite and quartz.

Fig. 2.



Londonderry Uniaxial Lepidolite.
Etching Figures on Basal Plane.
Similarly lettered boundaries are parallel.

This biaxial type is identical with the uniaxial in hardness, density, transparency and colour. It appears, however, to form somewhat smaller (though still at times large) sheets, and on occasion to form coarse aggregates in which several crystal individuals interpenetrate.

An optical examination revealed the fact that there were marked differences in the magnitude of the optic axial angle in different specimens. Three had identical angles, 2E = 52° 53′, whilst a series of eight other specimens had angles (2E) ranging from 5° 6′ to 12° 22′. The complete data for two specimens, one with the greatest angle, the other with a small angle, were—

(1.) 2E = 52° 53′, 2V = 33° 18′ ... Angle Bxa : C = 1°20′
Ng, 1·557 ; Nm, 1·553 ; Np·?

(2.) 2E = 8° 35′, 2V = 5° 32′ ... Angle Bxa. : C=3°
Ng, 1·555 ; Nm, 1·553 ; Np·?

The angles were measured by comparison with a basal section of aragonite under convergent polarised sodium light.

It was expected that a chemical analysis of the mica with the largest angle would reveal differences in composition sufficient to account for the optical differences. The figures given in column (3) below show, however, that there are practically no differences between the two, except in the manganese oxide content, which averages 1.28 in the uniaxial and 0.63 in the biaxial mineral.

It is to be noted that there is more lithia shown in two out of the three analyses than has ever previously been found in lepidolite, whilst there is only one higher value for fluorine recorded, viz., 8.71 in the mineral from Juschakowa in the Urals. These facts indicate that probably the Londonderry mineral is very close in composition to the pure lepidolite molecule, for which the analyses therefore provide a basis of calculation. The formula calculated is—

$$F_4Li_4K_2Al_4Si_8O_{23},$$

* Zeit. Kryst. 51.348 and Pl. VIII., 5.

or in other terms—

$2Li_2O.K_2O.4AlOF.8SiO_2$, or

$4LiF.K_2O.2Al_2O_3.8SiO_2$.

In this formula Na is capable of displacing Li to some extent, a displacement often noted in lithium minerals; whilst (OH) usually displaces a small part of the F. The composition of pure lepidolite calculated from the formula is—

Li_2O	K_2O	Al_2O_3	SiO_2	F	Total	Less $O = F_2$
6·77	10·68	23·11	54·46	8·61	103·63	3·63

Plotting the two minerals on Winchell's graphs (*loc. cit.*) it is found that the biaxial mineral occupies an almost normal position in the relationship of composition to optical properties, whilst the uniaxial mineral is abnormal. The cause of the optical differences between two such minerals, practically identical in composition and occurring in the same vein, is not yet explicable, unless it be that there is repeated twinning on the vertical axis in the case of the uniaxial mineral.

In the same pegmatite vein as the two lepidolites is a muscovite, which never appears in large sheets, but always as very imperfect prismatic crystals from 3 to 5 mm. in diameter and 1 cm. or more in height, arranged in parallel or slightly radiating groups. In colour it varies from colourless to pale mauve, lilac or sea green. Measurements of 2E in yellow light give 77° 48′ for the mean of two mauve crystals, and 76° 52′ for a green crystal. The composition of a mauve specimen is shown below.

ANALYSES OF LONDONDERRY MICAS.

	Lepidolite. Uniaxial.	Lepidolite. Uniaxial.	Lepidolite. Biaxial.	Muscovite. Biaxial.
Li_2O	5·83	5·97	6·37	0·32
Na_2O	1·03	2·43	·90	1·19
K_2O	11·18	10·31	11·10	10·71
SiO_2	51·67	51·00	52·57	45·22
Al_2O_3	23·22	24·13	23·01	37·46
Fe_2O_3	...	...	·08	trace
FeO	·04*	trace*	*Nil*	·56
MnO	1·37	1·20	·63	·71
MgO	·30	trace	*Nil*	·38
CaO	*Nil*	trace	*Nil*	·10
H_2O+	·44	·22	·59	3·68
F	8·22	7·79	8·26	·73
TiO_2	·06	trace	·04	n.d.
BaO, V_2O_3, Cr_2O_3, Cl	*Nil*	*Nil*	*Nil*	*Nil*
	103·36	103·05	103·55	101·06
Less O = F	3·46	3·28	3·48	·31
	99·90	99·77	100·07	100·75
D.	2·85	2·75	2·83	2·77
Analyst	H. Bowley	C. G. Gibson.	D. G. Murray.	E. S. Simpson

* May be present as Fe_2O_3.

(7.) TETRAHEDRITE, KALGOORLIE, CEN. DIV.

In Bulletin 42 of the Geological Survey a description was given of an arsenical fahl ore (tennantite) found rather frequently in small granular masses in the sulphide ore of the Boulder group of gold mines. This mineral contained the following amounts of arsenic and antimony—

	A.	B.	
Arsenic	16.87	10.01	per cent.
Antimony	4.30	9.57	,,

Up till recently no fahl ore had been detected at Kalgoorlie in which antimony preponderated over the arsenic. Dr C. O. G. Larcombe has now, however, kindly lent me for description a small (5 x 3 x 2 cm.) but very handsome speeimen eonsisting of coarsely crystallised tetrahedrite from a vugh in one of the deeper levels of the Ivanhoe G.M.

The erystals are imperfect through mutual interference, but range from 5 to 25 mm. along their longest edge. They are a combination of the tetrahedron ½(111) with broad bevels made up of an alternating development of two tetragonal trisoctahedra ½(411) and ½(211). Measured angles were (411):(141) = 60° and (211):(121) = 33½°.

The antimony and arsenic contents were determined on a small chip and proved to be—

Arsenic	.. ..	5.58 per cent.
Antimony	.. ..	21.36 „

(8a.) METEORIC IRON, MURCHISON DOWNS, MUR. DIV.

In his Annual Report for 1925 the then Government Geologist (A. Gibb Maitland) briefly records the addition to the Geological Survey collection of a meteorite from Murchison Downs (Lat. 26° 40′, Long. 119° 0′ approx.). Through the courtesy of the Acting Government Geologist (T. Blatchford) I am enabled to give a short description of it.

The iron is the smallest complete meteorite yet discovered in the State, weighing only 33.5 grams, with maximum dimensions, 43 x 30 x 10 mm. It shows no recent fracture faces but is entirely covered with the usual fused brown crust of oxides. It is pear-shaped, the narrow end being drawn off to a rather fine point. One side is approximately flat and exhibits a few typical concavities, the other side is convex but grooved.

A small portion of the surface was filed off and an area of about 10 mm. square polished. This on etching exhibited the usual three octahedral sets of kamacite lamellae, not, however, very regularly or plainly developed, probably because the etched section was so elose to the fused surface. The lamellae were 0.2 to 0.5 mm. thick, which shows the iron to belong to the "fine octahedrite" (Of) group of Brezina. Typical taenite and schreibersite were visible and a small oval grain of cohenite.

The filings when tested chemically gave a strong reaction for nickel.

(8b.) METEORIC IRON, EAST MT. MAGNET, MUR. DIV.

In his Annual Report for the year 1916 the writer gave a very brief account of a meteorite which had been found in that year and presented to the Geological Survey.* This body was not seen to fall but was discovered by Mr. James Connors 6 miles east of East Mt. Magnet (Lat. 28° 10′S., Long. 118° 30′E. approx.). Since that was written the meteorite has been analysed and etched so that more detailed particulars are now available.

As found, it was in two pieces, one large and one small. which fitted exactly together. It weighed in all 16.5 kilos (36½ lbs.) and was of a peculiar sickle shape as shown in the aecompanying illustration. Plate XXIII.

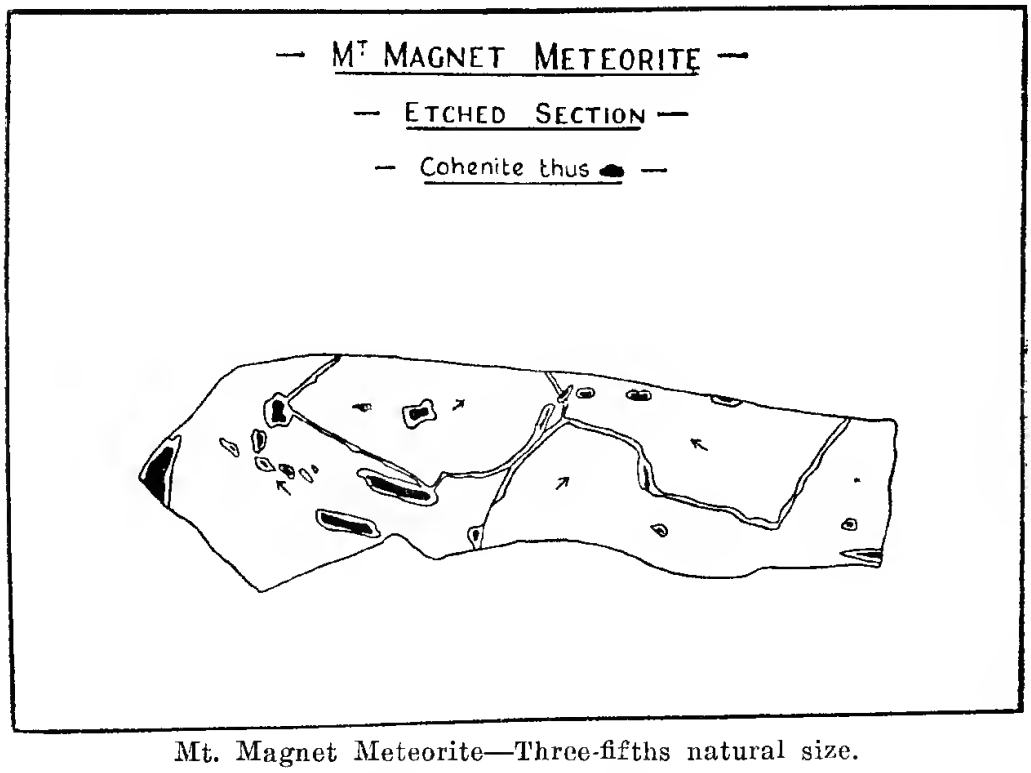
An analysis gave the following results:—

Fe	Ni	Co	P	C	S	Total	D
85·66	13·56	·77	·05	str ng traces	trace	100·04	7·967

* An. Rept. Geol. Surv. W.A., 1916, p. 26.

Two polished and etched sections revealed an unusual structure. The surfaces exhibited first a broad subdivision, with irregular outlines to the segments, which reached from 5 to nearly 10 centimetres in diameter. These segments had a faint schiller of varying orientation, indicated by the arrows in the illustration, Fig. 3. They were outlined by narrow

Fig. 3.



Mt. Magnet Meteorite—Three-fifths natural size.

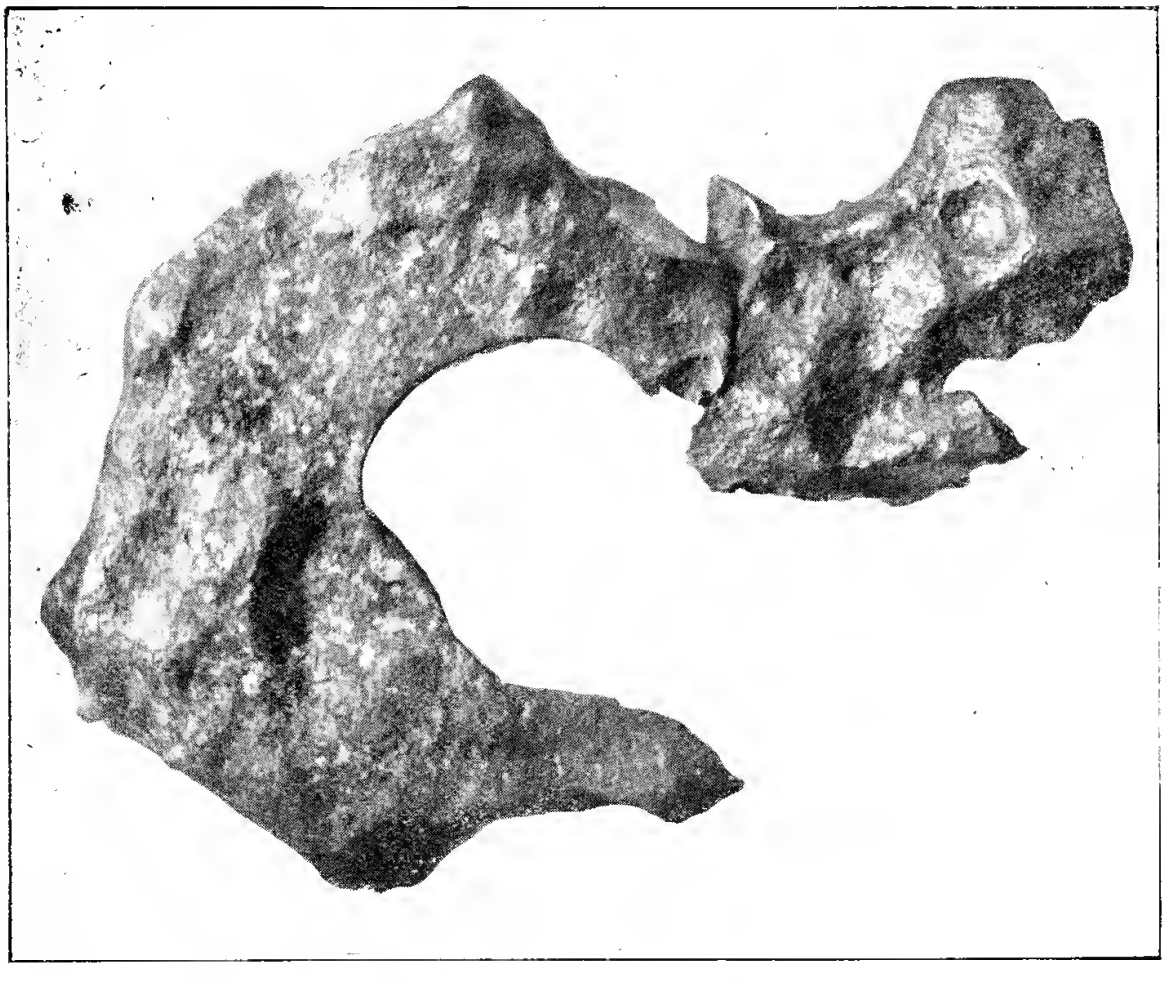
layers of schreibersite, occasionally including small masses of cohenite, and in places flanked on either side by a single rather broad (0.5 to 1.0 mm.) kamacite plate. This broad structure is best described as "brecciated."

The individual segments are very finely flecked internally, with no indication of Widmanstatten figures to the naked eye. With a low power (1 inch), however, the surface is seen to be composed of a mass of structureless plessite thickly strewn with short narrow (0.02 to 0.04 mm.)* discontinuous plates of kamacite, with appreciable parallelism in three octahedral directions. Dotted very irregularly over the section are masses of cohenite never exceeding 8 x 3 mm. They are surrounded by a layer of schreibersite alone, or by a further layer of kamacite. See Fig. 3.

In the second smaller section the structure still appears coarsely brecciated with only a minute flecking to the naked eye, but with low power shows a background of plessite with a distinct octahedral arrangement of narrow kamacite plates having borders of taenite plainly visible. The whole structure is much more continuous, though the area occupied by plessite still preponderates. No troilite was seen in any section.

From the above description it is evident that the Mt. Magnet meteorite is a siderite which would be classified in Brezinas system as "finest octahedrite, brecciated," with the symbol "Offb." According to Farrington's classification it belongs to the Tazewell Group of finest octahedrites characterised by a nickel content exceeding 10.5 per cent.

* The broader measurements probably representing oblique sections.



East Mt. Magnet Meteorite—One-quarter natural size.

3.—THE HELMINTHS OF WESTERN AUSTRALIAN STOCK.

Recorded and Unrecorded Species.

(With Four Figures, 4, 5, 6, 7.)

By H. W. BENNETTS, B.V.Sc.
Veterinary Pathologist, Department of Agriculture.

(Read 14th June, 1927. Published 24th October, 1927.)

In the course of my departmental duties during the past two years opportunities for the collection of helminths, both from material received at the laboratory and investigated in the field have been freely accepted.

The endoparasites of this State have been rather neglected, so that even many of the commoner species, affecting stock, have not been recorded, though in many cases their presence has been assumed.

(A) Recorded Species.

Sweet (1908) (a) gives the following list of species as having been recorded from W.A., Cleland, in most instances, being the original recorder—

1. *Trematodes.*
   Fasciola hepatica (in Ovis aries and Bos taurus).
   Paramphistomum cervi Zed. (in Bos taurus).

Both these records are for imported Eastern States beasts, not for W.A. stock.

2 *Cestodes.*
   Moniezia denticulata (in Bos taurus).
   Echinococcus polymorphus (in Ovis aries, Bos taurus, and Sus scrofa.
   Cysticercus tenuicollis (in Ovis aries and Sus scrofa).
   Thysanosoma ovilla (in Ovis aries).

3. *Nematodes.*
   Ascaris lumbricoides (in Sus scrofa).
   Habronema megastoma (in Equus caballus).
   Spiroptera sp. (in Bos taurus).
   Metastrongylus apri (in Sus scrofa).
   Dictyocaulus filaria (in Ovis aries).
   Dictyocaulus viviparus (in Bos taurus).
   Synthetocaulus rufescens (in Ovis aries).

Filmer, 1926, in a departmental communication (W.A.), in enumerating species, gives the following additional:—

1. *Nematodes.*
   Onchoncerca gibsoni—stated to be very common in Kimberley cattle; and has occasionally been seen in the cattle bred in the more southern districts. The Spiroptera sp. found in nodules by Cleland in 1907 he later referred to this species.
   Oesophagostomum columbianum, larvæ recorded from cattle by Cleland in 1908 (b).
   Haemonchus contortus recorded by Weston (c) in sheep. Filmer also reports it from cattle.
   Chabertia ovina was reported by Weston in sheep in association with the above-mentioned species.
   Ascaris megalocephala is also reported for the horse.

Other species enumerated, but not identified, by Filmer have been diagnosed by the writer and are given under the heading of unrecorded species.

With reference to the incidence of the recorded species, I have not as yet met with either species of Trematode. There appears to be no evidence of the existence of *Fasciola hepatica* in W.A. bred sheep, despite the certain introduction of the parasite for many years with sheep imported from the other Australian States.

Adult Cestodes are not uncommon in sheep or cattle, but none collected have been identified. *Echinococcus* cysts and *Cysticercus tenuicollis* are of course frequently met with in the hosts they are recorded for.

Of the Nematodes, *Ascaris* is very common in pigs and horses. *Habronema megastoma* nodules have been found in the great majority of the horses' stomachs received for investigation. *Dictyocaulus filaria* is common and has a wide distribution, though in my experience heavy infestations are relatively uncommon.

On the other hand, *Haemonchus contortus* appears to find conditions favourable in many districts. Heavy mortalities in sheep, particularly weaners, due to *Haemonchus contortus* alone, or in association with stomach worms, notably *Ostertagia spp.,* are being continually brought under the notice of this department. I have also received specimens of *Haemonchus contortus* from cattle.

Chabertia ovina has been found in a large percentage of sheep examined and has a wide distribution.

Lesions in the intestines of cattle and pigs identical with those of Oesophagostomiasis have frequently been encountered, but no detailed examinations have been made. Worm nodules assumed to be those of *Onchocerca gibsoni* have been seen commonly in the shipments of North-West cattle and twice in locally bred cattle.

(B) Unrecorded Species.

As species here recorded have, with the probable exception of four, been described as being present in Australia, full detail is not given. Where available original descriptions have been followed, otherwise recognised monographs, and text books have been relied on for diagnosis. Only special features presenting themselves have been mentioned.

In dealing with Nematodes the classification given by Yorke and Maplestone (d) has, in general, been followed.

Specimens have been preserved in 70 per cent. alcohol, and Nematodes have been cleared and examined in Carbolised absolute.

1. *Trematodes.*
   To date none have been received.

2. *Cestodes.*

   (1) *Choanotaenia infundibuliformis* (Goeze., 1792).
   = *Drepanidotaenia infundibuliformis* Railliet, 1892.
   Host—Fowl: intestines.
   Locality—Markets, Perth, 14/5/26.
   Remarks—Bird seized for emaciation due to other causes.

(2) *Davainea sp.?*
Segments only.
Host—Fowl: intestine.
Locality—Perth, 15/1/26.
Remarks—At the time of collection these specimens were referred to above, but as they were not retained, further examination is impossible.

(3) *Dipylidium caninum* (Linne, 1767).
= *Taenia canina* (Linne, 1767).
= *T. cucumerina* (Bloch, 1782).
= *T. elliptica*:
Segments only.
Locality—Dumbleyung, July, 1925.

Remarks—The parasite is quite probably a common one, but very little canine material has been available for examination.

3. *Nematodes.*

(1) *Trichuris suis* (Schrank, 1788).
= *Trichocephalus apri* (Gmelin, 1790).
= *Trichocephalus crenatus* (Rud., 1809).
Host—Pigs: caecum and colon.
Locality—Various.

Remarks.—Apparently a frequent and widely distributed parasite of pigs in this State.

(2) *Strongylus equinus* (Mueller, 1780.)
= *Sclerostomum equinum* (Mueller, 1780; Looss, 1900).
= *Strongylus armatus* (Rud., 1802).
Host—Horses: intestines.
Locality—Perth, August, 1926.
Bruce Roek, 16/2/27.

Remarks.—This species has been frequently noticed in horses in the Metropolitan Area.

(3) *Strongylus edentatus* (Looss, 1900).
Host—Horse: intestines.
Locality—Perth, 3/1/26.

(4) *Strongylus vulgaris* (Looss, 1900).
Host—Horse: intestine.
Locality—Bruce Roek, 16/2/27.
Remarks—Also noted in Metropolitan Area.

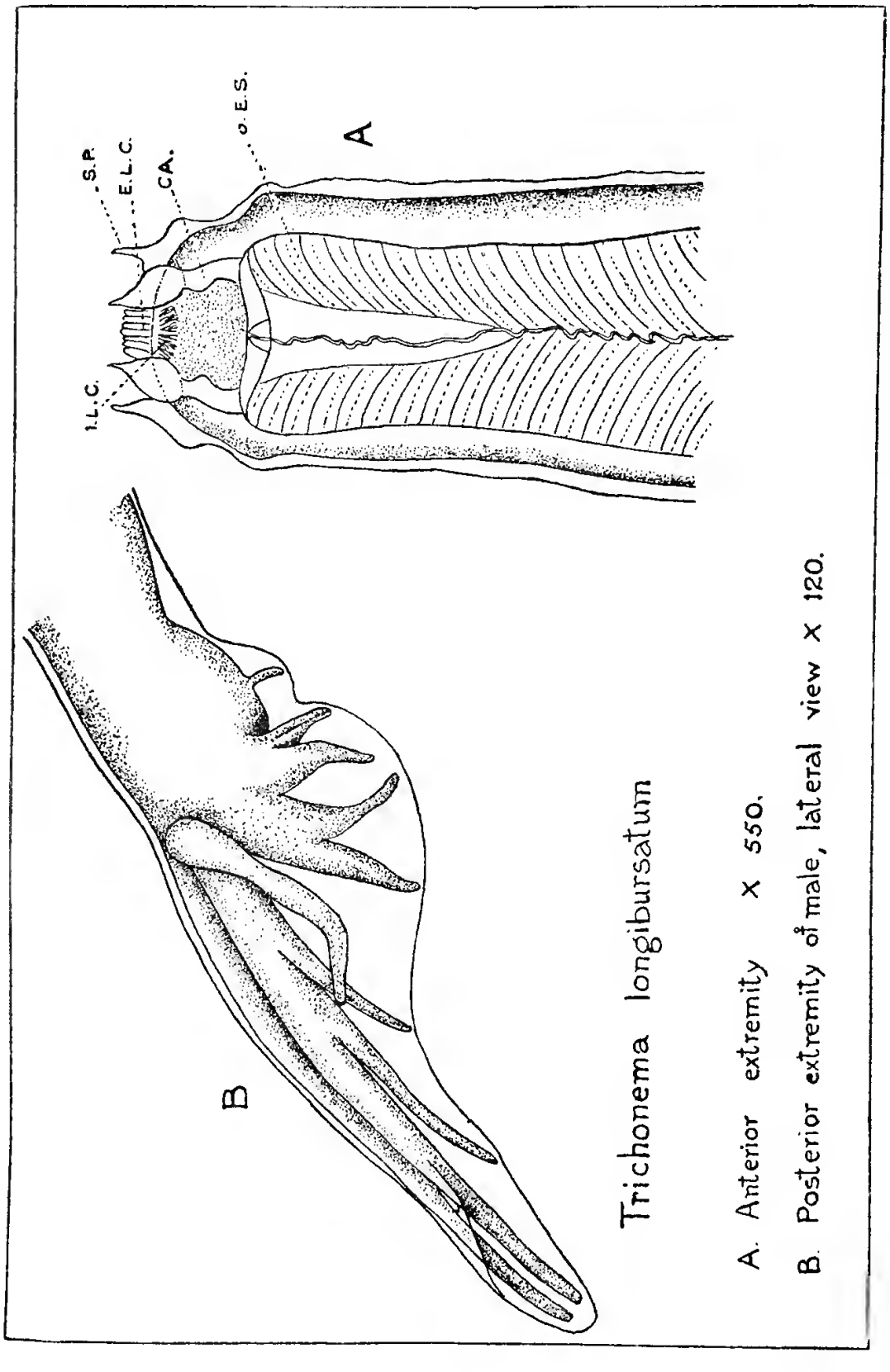
(5) *Trichonema longibursatum* (Yorke and Macfie, 1918). (e)
= *Cylicostomum longibursatum* (Yorke and Macfie, 1918).
= *C. calicatiforme* (Koltan, 1920).
= *C. nanum* (Ihle, 1919).

Seven specimens, four males, three females.

Length: Males, 4.8 to 6 mm., average length 5.4 mm. Females 5.2 to 6 mm., average length 5.5 mm.

The specimens were first referred to the Subgenus Cylicostephanus, Ihle 1924, as quoted by Yorke and Maplestone. Following this, the details in all specimens have been carefully compared with those of the original descriptions of *T. longibursatum,* and, except where otherwise mentioned, concur with them.

Fig. 4.


A
S.P.
E.L.C.
CA.
O.E.S.
I.L.C.
B
Trichonema longibursatum
A. Anterior extremity × 550.
B. Posterior extremity of male, lateral view × 120.

No transverse section of the mouth capsule was made.

The original description is easy of access to Australian workers; the main diagnostic characters as given for the type species are—

(1) "Very small size; average length, male and female, 5.1 mm.

(2) Buccal capsule: anterior opening circular; walls, when seen in optical section, kneed; ratio of breadth, at anterior opening to antero-posterior diameter, 1 to 1.

(3) Dorsal oesophageal gutter projects slightly into buccal capsule.

(4) Dorsal lobe of bursa very long and narrow; ratio of length of posterior ray to total length of male worm, 1 to 8.

(5) Termination of female body and tail straight."

The only divergencies in my specimens from the above-mentioned characters were—

Greater length, average, males 5.4 mm.; females 5.5 mm.; as against 5.1 for both males and females of *T. longibursatum*. Yorke and Macfie give, however, 5.5 mm. as the maximum length for the male and 5.7 mm. for the female. Again, the ratio of the length of the posterior (dorsal) ray of the bursa to the total length of the body of the male is as 1 to 7.8 as against 1 to 8 for *T. longibursatum*. Otherwise the quoted description fits the W.A. specimens.

More detailed divergencies from the original description were that the walls of the buccal capsule (vide Fig. A) appear rather stouter than those illustrated for *T. longibursatum*. In the mouth capsule the average antero-posterior diameter of seven worms is 19.3 microns with a variation of 18.6 to 20 microns; as against *T. longibursatum* 19 microns with a variation of 17.5 to 20 microns. The lateral diameter at the anterior openings averaged (seven worms) 19.5 microns with a variation of 18.6 to 21 microns; as against *T. longibursatum* 19 microns with a variation of 18 to 20 microns. That of the posterior opening averaged 27.4 microns (seven worms) with a variation of 24.8 to 29.5 microns; as against *T. longibursatum*, average 26 microns with a variation of 24 to 28 microns. In two males examined the length of the main trunks of the posterior (dorsal) ray were 750 to 765 microns. The corresponding measurement for 10 specimens of *T. longibursatum* is given as 594 to 659 microns with an average of 631 microns. The bursa apart from the slightly longer dorsal ray is identical with that of *T. longibursatum*. Plate 24.

The specimens described appear to be very slightly larger than *T. longibursatum*, but despite this fact, in view of the almost exact concurrence in detail with the original description, I think that a definite diagnosis for Western Australian specimens is justified.

Host—Horse: colon.

Locality—Perenjori, 10/12/26.

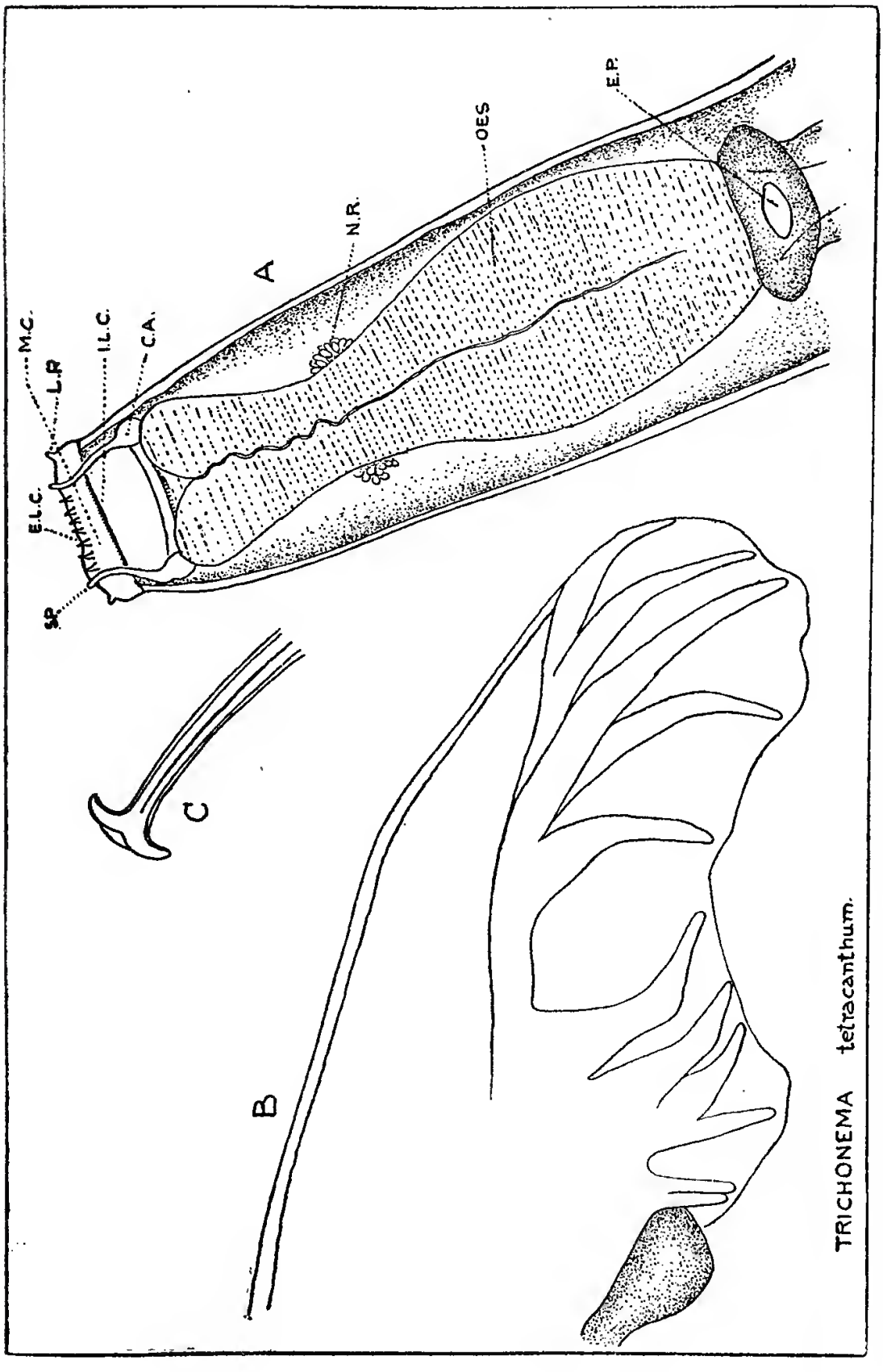
(6) *Trichonema tebracanthum* (Mehlis, 1831; Railliet and Henry, 1919.

= *Strongylus tebracanthus* (Mehlis, 1831).

= *Cylicostomum insigne* (Boulenger, 1917).

Four specimens, two males and two females. Length—males both 10 mm.; females 12 and 14 mm. The diagnosis is based on comparison with Cram's Key to "Strongylidae of the Horse, Donkey, Mule and Zebra," (k)

Fig. 5.



and Boulenger's original description of *C. insigne* (†), these being the only references available. By means of Cram's Key the specimens were put into the genus Trichonema Cram, 1924 = Subgenus Cylicocylus Ihle 1922, as quoted by Yorke and Maplestone, and were referred to *T. tebracanthum.* The specific characters of the specimens examined agreed accurately with those described by Boulenger for *C. insigne* which Cram states has been shown by Railliet to be identical with *Trichonema tebracanthum* (Mehlis, 1831). The main characters of the subgenus Cylicocylus are—

"Posterior margin of mouth capsule with a hoop-like thickening, the elements of the internal leaf crown small and originating near anterior margin of mouth capsule. The posterior extremity of the female straight or slightly bent dorsally."

In specific characters the specimens examined differ from those described only in that the males were slightly below the given length, viz., 10 mm. instead of 11 to 12 mm., and in that the number of teeth in the external leaf crown appeared to be about thirty instead of "about thirty-six." Important characters for specific identification were the absence of dorsal gutter and the fact that the excretory pore was at junction of œsophagus and intestine (A, Fig. 4). The characters of the bursa (B, Fig. 5) did not differ markedly from those given for *C. insigne.* The microscopic measurements of the four specimens examined were in accord with those described for *C. insigne,* viz., Mouth capsule has a depth of 56 to 70 microns, and a maximum breadth of 140 to 170 microns. Oesophagus, length 720 to 900 microns, maximum breadth 240 to 300 microns. The cervical papillae 900 to 950 microns from anterior extremity.

In the females—maximum breadth near middle of body 825 to 850 microns; vulva 375 and 405 microns from posterior extremity, and at this level body has a width of 300 microns; anus 165 and 240 microns from posterior end; eggs averaged about 75 x 50 microns.

In the males, maximum breadth was 700 and 750 microns, slightly broader than that described for the species, viz., 620 to 690 microns.

Host—Horse: colon.
Locality—Perenjori, 10/12/26.

Remarks.—Not to my knowledge any previous record for Australia. This species was present in great numbers in association with preceding species.

(7) *Ostertagia ostertagi* (Stiles, 1892).
= *Strongylus ostertagi* (Stiles, 1892).
= *S. convolutus* (Ostertag, 1890).
= *S. cervicornis* (McFadyean, 1897, in part).
= *S. harkeri* (Stodter, 1901, in part).
Host—Heifer: nodules in abomasum.
Locality—Denmark, 18/1/27.

Remarks.—Parasites—presumably this species—have been noted by officers of this department, in similar lesions, for some years, particularly in the South-West of the State. Their presence has been associated with a similar syndrome to that observed at Denmark; the condition which particularly affects young cattle is characterised by progressive emaciation, intermittent diarrhoea, and ravenous appetite. Death follows if cattle are not given a change of country. It is not yet decided, however, whether the parasite is primarily responsible for the trouble, there being some evidence of mineral deficiency acting concurrently.

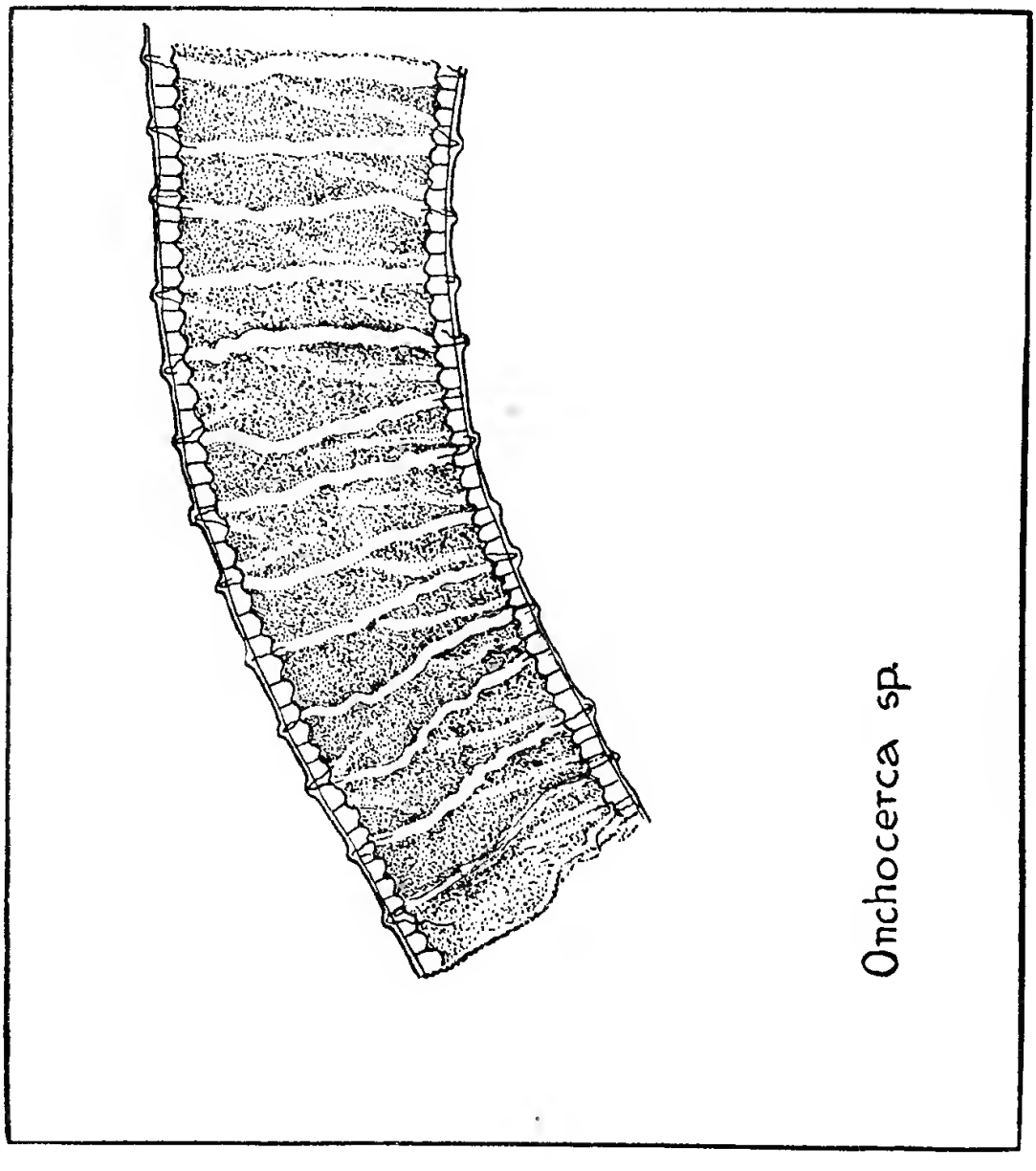
(8) *Ostertagia sp.*

Numerous specimens differing from the above mainly in absence of cuticular flap covering vulva in the female have been received at different times.

Host—Sheep: abomasum (free).

Locality—Chittering, Dinninup, etc.

Fig. 6.



Remarks.—This species is sometimes found in association with *H. contortus.* In the absence of necessary literature I am unable at present to give a specific identification.

(9) *Oxyuris equi* (Schrank, 1788.

= *Trichocephalus equi* (Schrank, 1788).

= *Oxyuris curvula* (Rud., 1803).

= *Oxyuris mastigodes* (Nitzesh, 1857).

= *Lepturis curvula* (Rud., 1803; Schlotthauber, 1860).

Two specimens, both females, first 2.5 cm. long, second 5.5 cm. long. First was sexually mature and in all respects except small size; Yorke and Maplestone give 4 cm. as minimum length; identical with this species.

Host—Horses: rectum.

Locality—Perth, First specimen, 1/3/26.
Second specimen, 4/2/27.

This species has often been seen but has not been recorded for this State.

(10) *Toxocara canis* (Werner, 1872).
= *Lumbricus canis* (Werner, 1872).
= *Ascaris werneri* (Rud., 1793).
= *Ascaris marginata* (Rud., 1802).
= *Belascaris marginata* (Rud., 1802; Railliet and Henry, 1911).

Host—Dog: intestines.

Locality—Perth, 20/11/26.

(11) *Ascaridia lineata* (Schneid, 1866).
= *A. hamia* Lane, 1914.

Thirteen specimens, six males, seven females. Lengths—males 4.5 to 5.7 cm., females 5.8 to 7.2 cm.

The diagnosis is based on comparison of the specimens with descriptions of *A. lineata* given by Schwartz (g). The number and arrangement of the genital papillae in the males corresponded in every case with those described for this species.

They are ten in number with the following arrangement:—"The first group consisting of three pairs (ventral) arranged in a linear series on each side of the sucker, the second group consisting of four pairs (three lateral and one ventral), and the last group consisting of three pairs (two lateral and one ventral)." Vide Text Fig.

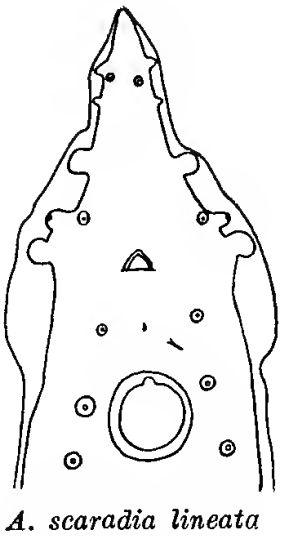
Host—Fowl: intestines.

Locality—Perth, Oct., 1926.

Remarks.—Ascaridia sp. in fowls, which on all occasions where a detailed examination has been made, have been found to be *A. lineata,* are widely distributed over the Metropolitan Area and probably outside it. Heavy infestations appear to be associated with lowered egg production.

Apparently not recorded as such in Australia.

Fig. 7.



A. scaradia lineata
(original) x 23.

(12) *Heterakis vesicularis* (Frolich, 1791).
= *Ascaris papillosa* (Bloch, 1782, in part).
= *Ascaris vesicularis* (Frolich, 1791).
Host—Fowl: caecum.
Locality—Perth, 6/1/26.

Remarks.—Specimens apparently this species have been noted on several occasions, but not as commonly as *A. lineata.*

(13) *Habronema microstoma* (Schneider, 1866).
The specific details agree with those given by Ransom (h).
Host—Horse: stomach.
Locality—Perth, 2/12/25.

Remarks.—This species has only been observed on this one occasion.

(14) *Habronema muscae* (Carter, 1861).
= *Filaria muscae* (Carter, 1861).

Three specimens, all females. The specific details agree with those given by Ransom (h).
Host—Horse: stomach.
Locality—Perth, 29/3/27.

Remarks.—This specimen has only been noted on a few occasions, but is probably not uncommon.

(15) *Onchocerca sp.,* probably *O. cervicalis* (Railliet and Henry, 1910).

Numerous incomplete specimens; one male almost complete, posterior extremity being mutilated, was 34 mm. long with maximum breadth of 150 microns, head 50 microns wide. One portion of a female was 73 mm. long, breadth 250 to 350 microns. The worms were filiform and refractile, except degenerated portions which were white and brittle. In two heads examined mouth was simple without lips or papillae.

The cuticle in the female was transversely striated and, characteristically, as described for the genus, reinforced externally by spiral thickenings (Plate XXV.) absent in the male.

Host—Horse: ligamentum nuchae and inflammatory fibrous tissue, in one subject (fistulous wither).
In discharge from fistula in second subject.
Locality—1st Subject, Zoo, Perth, 24/3/27.
2nd Subject, Peel Estate, 31/3/27.

Remarks.—Though the specimens examined were not complete enough for a specific diagnosis to be made, the habitat would suggest that the specimens were probably *O. cervicalis.*

Robson, of Perth, has long been acquainted with these worms and regards them as frequent cause of fistulous withers. He has described the clinical aspect (i). As far as I am aware this parasite has not previously been recorded in Australia. Clinical evidence would indicate that its incidence is by no means infrequent in this State and would ascribe to it an important pathological rôle.

I am hoping to obtain more favourable material. The first specimens were obtained by the courtesy of Weston, and Le Souef, from diseased tissue of a horse which was killed at the Zoo, having been affected with a long standing fistula. The undegenerated specimens were few in number and

were embedded in healthy elastic tissue being difficult to find. Time did not permit of the careful dissection required to obtain whole specimens being made. Chalky foci were present in the diseased tissue and were probably, as suggested by Robson, originally areas of parasitic invasion.

The second specimen forwarded from a Government horse at the Peel Estate by Senior Agricultural Advisor J. T. Armstrong, was portion of a partially degenerated female embedded in inspissated pus which was discharged from the fistula.

Robson states that in earlier acute cases of fistulous withers the parasites are very numerous and are found free in pockets of pus, etc., but later degenerate. Before this degeneration takes place surgical procedure is said to be of little avail.

Cases of "dropped shoulder" in unbroken horses are also ascribed by some to the effect of these parasites.

There is no information as to their incidence in normal horses, but this question is to be investigated.

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EXPLANATION OF FIGURES.

All figures drawn by aid of Camera lucida.

Fig. 4.—*Trichonema longibursatum* (Yorke & Macfie, 1918).

A.—Anterior extremity X 550.

I.L.C. = Internal leaf crown.
S.P. = Submedian head papilla.
E.L.C. = External leaf crown.
C.A. = Wall of mouth capsule.
O.E.S. = Œsophagus.

B.—Posterior extremity of male, lateral view X 120.

Fig. 5.—*Trichonema tetracanthum* (Mehlis, 1831).
Railliet & Henry, 1919.

A.—Anterior extremity X 100.

M.C. = Mouth collar.
L.P. = Lateral head papilla.
N.R. = Nerve ring.
E.P. = Excretory pore.

B.—Ventrolateral view of bursa X 80.

C.—Terminations of spicules X 550.

Fig. 6.—*Onchocerca* sp.
Portion of female worm X about 100, showing spiral thickenings reinforcing cuticle.

4.—CONTRIBUTIONES FLORAE AUSTRALIAE OCCIDENTALIS VI.

(With Four Plates xxiv.-xxvii.)

CHARLES A. GARDNER, Department of Agriculture.

(Read 14th June, 1927; Published 24th October, 1927.)

Septem novae species hic descriptae, duo si exceptis, sunt e recentibus collectionibus ab auctore ipso factis, earum typi inveniuntur apud Herbarium, Departmenti Agruculture, Perth.

Novae species propositae sunt quae sequentur:

Casuarina fibrosa.
Banksia violacea.
Banksia audax.
Dryandra erythrocephala.
Baeckea muricata.
Astartea heteranthera.
Balaustion microphyllum.

Quae sequenter sunt potius synonima:

Casuarina horrida, Herbert.
Casuarina spinosissima, Gardner.
Casuarina leptotrema Sp. Moore.
Adenanthos intermedius, Ostenfeld.
Adenanthos intricata, Gardner.
Dryandra teretifolia, Morrison.
Pultenaea astipulea, Herbert.
Pomaderris Mayeri, Gardner.
Hannafordia Bissillii, F. v. M., var. latifolia, Pritzel.
Melaleuca coronicarpa, Herbert.
Duboisia Campelli, Morrison.

Casuarina fibrosa, Gardner, n. sp. Plate xxiv. A-F.

Frutex parvus erectus, dense ramosus, ramulis ramisque erectis, dense appressis. Internodis 3-4, fere teretibus, internodus ad basin positus brevius omnibus, estque eximie striatus et ex apice pungenti acuto. Verticillus dentatis 4, scariosus ad basin vaginatus; apicibus irregulariter divisis. Amentis masculis non visis.

Strobilis ovoidei-globularibus, arcte sessilibus in annoso ligno, absconditis inter ramas compressas. Bracteis pusillis, bracteolis exsertis, gracilibus, ovato-lanceolatis, acutis, appendice dorsali triangulari, parce truncatis vellatis e rudibus fibris, pilus similantibus, nascentibus ex exteriori basi bracteolarum multo longioribus bracteolis ipsis. Achaenibus glabris, luteofuscis, ovoidiis, ala achaenibus ampliori, subacutis e parvo puncte cuspidato.

Frutex ca. 30-40 cm. altus, ramulis 2.6-3 cm. long. Strobilus 1.5-1.7 cm. long $\times$ 1.4 cm. lat.

Hab. in distr. Avon prope Tammin in arenosis aridis apertis. Sept., 1926. (C. A. Gardner.)

A small erect densely branched shrub, branchlets and branches erect, densely crowded. Internodes 3-4, terete or almost so, the basal one the shortest, finely striate, the apex pungently acute. Teeth of the whorl 4, scarious, united at the base to form a sheath, the apices irregularly divided. Male amenta unknown.

Cones ovoid-globular, closely sessile on the older wood and hidden among the dense branches. Bracts small, thickened into a broad shortly-pointed apex; bracteoles exserted, thin, ovate-lanceolate, acute, the dorsal appendage triangular, shortly truncated, hidden by coarse hair-like fibres which arise from their outer bases and much exceed the bracteoles in length. Achenes glabrous, reddish-brown, ovoid, the wing broader than the achene, sub-acute with a small cuspidate point.

The new species belongs to the series with 4-6-merous whorls and definite internodes, its affinity being with *C. microstachya* and *C. grevilleoides*. It differs from the former in the terete branchlets and the bracteoles, and from *C. grevilleoides* in the glabrous achene and number of internodes, differing from both, however, in the long fibrous appendages of the bracteoles. The habit is more like that of *C. gravilleoides* than of *C. microstachya*.

Banksia violacea, Gardner, n. sp. Plate xxiv. K-O.

Fruticulus humilis, rigidus, dense ramificatus, omnino glabris inflorescentia excepta. Foliis compressis in ramulis, erectis, lineari-oblongis, mucronatis, planis, crassis, subtus bisulcis vel subcanaliculatis, margine arcte revolutis. Spicis terminalibus, globosis, erectis vel rare reflexis, rhachis brevis. Bracteis dense tomentoso-villosis, etiam ad apicem. Perianthium atro-violaceo, parce sericeo e pilis albis appressis, pilis in ovoideo-elliptico limbo densior appressis, pallidis, Ovario glabro. Stylo apprehenso per stigmatem obtuse conicum ad basin incrassatum. Conus fructiferens globosus, crassis glabris capsulis truncatis, conjunctim valde appressis, turgidis planis.

Fruticulis 25-35 cm. alt. Folia 1.0-1.5 cm. long., 1.5 mm. latus. Spicis ca. 4.9 cm. diam. rhachi 2.0-2.3 cm. long. Perianthiam ca. 1.7 cm. long. limbo 2.5 mm.

Hab. in distr. Stirling, ab Lake Grace orientem versus, in arenosis fruticetis apertis, fl. m. Decem. (C. A. Gardner.)

A small, erect, densely branched shrub, quite glabrous except the inflorescence. Leaves rather crowded on the branchlets, erect, linear-oblong, mucronate, flat and thick, the margins so very closely revolute as to give the impression of a flat entire leaf, the broad midrib only evident on the lower side. Spikes terminal, globular, erect or rarely reflexed, the rhachis short. Bracts densely tomentose-villous without any glabrous apex. Perianth dark purple-violet, sparingly silky with short oppressed white hairs, the limb ovoid-elliptical with rather denser appressed yellowish hairs, more or less acute. Ovary glabrous. Style remaining hooked with an obtusely conical stigma swollen at the base. Fruiting cone globular, the thick glabrous capsules truncate and closely pressed together, turgid and smooth.

This species of the Section Oncostylis is close to *B. nutans*, differing principally in the less conspicuous bracts which have not the prominent glabrous umbonate tips of that species, the violet flowers (not yellow), the smaller broader leaves not deeply channelled above, and the habit, together with a differently proportioned perianth-limb, as well as the vestiture of the perianth.

Banksia audax, Gardner, n sp. Plate xxiv. G-J.

Frutex parvus e fere diffusis ramis, glaber, spicis exceptis. Folia dispositis in brevibus lateralibus ramulis, lineari vel oblongo-cuneatis, truncatis, coriaceis, rigidis et planis, marginibus dentatis, dentibus paucis, brevibus, pungentibus, sini non profundi; facies superiori plana, media costa centralis leviter impressa, venis anastomosis non valde visibilibus in facie inferiori.

Spicis ovoidis, super pedunculos longos, floribus aurantiaco-pallidis. Bracteis ferruginoso-tomentosis. Perianthio oblongum obtusum limbum habente dense tomentoso-villosum, sub limbo tenuiter villosa cum capillis pallidioribus. Stylo rigido perianthio longiore, ovario glabro super parvum stipitem villosum ex longis sericeis albis pilis.

Capsulis denso appressis apud durum lignosum conum, valvis tomentosis fere absconditis apud reliquias florum persistentes.

Frutex 30-40 cm. alt. 70-80 cm. diam. Folia 4-6 cm. long., ad 1.5 cm. lat. Spicis 5.5-6.5 cm. long., 5.0 cm. latus. Perianthium ca. 2.0 cm. long. limbi lobi 4.5 cm.

Hab. in Distr. Coolgardie, in arenosis aridis apertis prope Bronti, flor. m. Decem. (C. A. Gardner, Dec. 1926.)

A low shrub with spreading, almost diffuse, branches, glabrous except the spikes. Leaves clustered on the short lateral branchlets, linear-cuneate to oblong-cuneate, truncate, coriaceous, rigid and flat, the margins dentate, the teeth few, short and pungent, the sinuses separating them not deep, the upper surface smooth with the midrib slightly impressed, the anastomosing veins not very evident on the under surface.

Spikes ovoid, on usually long peduncles, the flowers golden-yellow. Bracts ferruginous-tomentose. Perianth with an oblong obtuse limb densely tomentose-villous, the slender part below the limb scantily villous with paler coloured hairs. Style rigid, longer than the perianth, the ovary glabrous on a short thick stipes villous with long silky white hairs. Capsules densely packed in the hard woody cone, the valves tomentose, almost concealed in the persistent remains of the flowers.

This species belongs to the Section Crytostylis of Bentham, and is nearest to *B. attentuata* and *B. media*. *B. attenuata* is a tree with very different leaves and cylindrical spikes and a glabrous perianth. It differs from *B. media* in the shape of the leaf, and more decidedly in the perianth limb, which in *B. media* is never tomentose, and more elongated and angular. I fail also to find any hairs to the stipes in Maxwell's specimens of *B. media*, but these are very old.

Dryandra erythrocephala, Gardner, n. sp. Plate xxv. A-H.

Fruticulus compactus humilis, foliis erectis fasciculatis, attenuato-petiolaris, pinnatipartitis, lobi remotis, patulis, sinu brevioribus, lineari-subulatis, pungentibus, margine revolutis, subtus tomentosis, rhachi anguste-linearibus. Capitulis terminalibus, sessilibus, foliis floralibus obvallatis; squamis exterioribus linearibus plumosis, interioribus setaceo-acuminatis. Perianthium elongatum, supra basim glabrum, dense lanatum, laminis glabris purpureis, stigmate tenui subacuto.

Fruticulus 15-25 cm. alt., folia 5-8.0 cm. long., lobi 3-6 × 1 mm.; involucrum ad 2.5 cm. long. (foliis floralibus exceptis); perianthii segmenta 3.8 cm. long., limbi lobi 7 mm. Stylus 3.6-3.7 cm. long.

Hab. in distr. Stirling ab Pingrup orientem versus in arenosis aridis fruticulosis, flor. m. Decem. (C. A. Gardner, Decem. 1926.)

A small compact shrub of low stature, the branches covered with persistent bases of the fallen leaves, otherwise leafless except towards the summit. Leaves crowded around the flower-heads, deeply pinnatifid with rather distant linear or lanceolate pungent segments, the margins revolute, reddish-tomentose underneath. Flower-heads narrow, terminal on the crowded short terminal or lateral branchlets, and buried in the numerous floral leaves which much exceed the flowers in length. Outer involucral bracts indistinguishable from the floral leaves, the inner linear-setaceous, dark-coloured with a narrow scarcely dilated base and long plumose points, shorter than the flowers.

Perianth turgid above the glabrous base, densely white-villous on the swollen part, the slender portion of the claws sparingly pubescent in the lower part, the greenish upper portion and the bright red limb glabrous. Style shorter than the perianth, the stigmatic end slender, sub-acute and smooth.

This species has the characters of the *Obvallatae* and the *Armatae*; and demonstrates the affinity between the two series. From *D. Fraseri* it differs in habit, involucre, and the structure of the perianth, but has the same terminal though more crowded inflorescences. Among the *Obvallatae* it is closely related to *D. seneciifolia* and *D. cirsioides*, differing from both in the terminal inflorescences; from *D. seneciifolia* in the smaller involucre and much larger and different perianth, and from *D. cirsioides* in the leaves, the involucral bracts, and (according to Meissner's description) in the vestiture of the perianth. It doubtless has some affinity to *D. Purdieana* but is very different in the leaves and involucre.

Baeckea muricata, Gardner, n. sp. Plate xxvi.

Parvis diffusus frutex etiam juvenibus ramis inclusis, ramis rigidis; foliis et calycibus muricatis processibus in calyce prominentioribus quam in descrepitis ramulis. Foliis oppositis in parvis lateralibus ramulis, magis minusve erectis, oblongo-linearibus, subteretis, obtusis, subtus canaliculatis.

Floribus solitariis, e parvo pedicello, articulatis, bracteolis ad basin duo, angustis, deciduis, rare duo vel tres flores in eundem parvum pedicellum. Tubo calyceo campanulato-turbinato, muricato cum longioribus processibus quam in foliis et ramulis, lobis parvis et angustis, crasse muricatis. Petalis orbicularibus, albis, crispis; staminibus 20, inflectis nequaquam oppositis petalis; filamenta vix ad basin dilatata; connectivum prominens; antheris fere globularibus. Ovarium triloculatum, locis 6-9-ovulatis.

Frutex 50-80 cm. altus. Folia 2.5-4.0 mm. long. Pedicellis ca. 2 mm. long. Calycis tubus 2.5 mm. long; calyx cum lobis 3.5 mm.; petala 3.5 mm.

Hab. in distr. Coolgardie prope Bronti, in arenosis fruticetis, fl. m. Decm. Eadem pr. Carrabin, in acacietis lutosis, fl. m. Novem.-Decem. (C. A. Gardner, Dec., 1926).

A low spreading shrub with rigid branches, the whole plant including the younger branches, leaves and calyxes muricate with stout but soft processes which are however most prominent on the calyx, those on the older branchlets soon wearing off. Leaves mostly along the short lateral branchlets, more or less erect or slightly spreading, but not imbricate, oblong-linear, subterete, obtuse, channelled underneath, covered all over with stout hair-like semi-transparent processes.

Flowers solitary on a short pedicel articulate with two narrow deciduous bracteoles at the base, or rarely 2 or 3 flowers together on a short peduncle. Calyx-tube campanulate-turbinate, muricate with much larger processes than those of the leaves and branchlets, the lobes short and narrow, also thickly muricate and separated by broad intervals. Petals orbicular, white, crisped. Stamens 20, inflected, none opposite the centre of the petals; filaments scarcely dilated towards the base, the connective prominent; anthers almost globular, the cells opening in oblong terminal pores. Ovary 3-celled, with 6-9 ovules in each cell.

This species, belonging to the Section *Babingtonia,* appears to be fairly close to *B. robusta,* but differs from it in the pedicels, calyx-lobes, and from this and all other species of the genus at present known in the remarkable vestiture, particularly that of the flowers.

Astartea heteranthera, Gardner, n. sp. Plate xxvii.

Parvus diffusus frutex, glabrus, ramis mollibus, diffusis. Foliis linearibus clavatis, subteretibus, obtusis, potius crassis, ad basin angustis, apud breves laterales ramulos congestis. Floribus solitariis pedicellis foliis superantibus, articulatis, proper basin cum duobus parvis lanceolatis concavis bracteolis. Calycis-tubo turbinato-rotundo, plano vel obscure quinque costato; lobis parvis et amplis, rotundis, centris incrassatis. Petalis orbicularibus, integris, albis. Staminibus ca. 10-12 brevibus, irregulariter inferne in annulum confluentibus, loculis antherae distinctis, ovoideo-globularibus, longitudinaliter dehiscentibus. Ovario 3-loculari; summitate convexa, stylo inserto in depressione centrali. Ovulis 2, collateralibus.

Frutex ca. 40 cm. altus; foliis 3-7 mm. longa. Calyx cum lobis ca. 3.5 mm. latus, 2-2.5 mm. altus. Pedunculi 4 mm. longa; petala 3 mm. diam.

Hab. in distr. Avon prope Wongan Hills, in arenosis, flor. m. Aug. et Sept. (E. H. Ising, Sept., 1925.)

A small spreading shrub with slender spreading branches, quite glabrous. Leaves linear-clavate, subterete, obtuse, rather thick, narrowed towards the base, clustered on the short lateral branchlets. Flowers solitary on slender pedicels exceeding the leaves, articulate near the base with two small lanceolate concave bracteoles. Calyx-tybe turbinate-hemispherical, smooth or obscurely 5-ribbed; lobes short and broad, hemispherical with thin coloured margins and thickened centres. Petals orbicular, entire, white. Stamens usually 10-12, the filaments of unequal length but all short and dilated, more or less united in a ring deeply divided into five segments opposite the sepals, but variable in size, usually with a short filament between

two longer ones, or the bundle consisting of united filaments with one anther, or sometimes two or four anthers in the segment. Anther cells distinct, ovoid-globular, opening longitudinally in front of the summit of the filament. Ovary with a convex 3-angled summit, 3-celled, the style inserted in a central depression. Ovules 2 in each cell, collateral.

This new species is close to *A. ambigua,* F. v. M., which Niedenzu unites with *Baeckea.* Since, apart from the above species, I know of no species of *Baeckea* with united filaments I have placed the new plant in the genus *Astartea.* It differs in several respects from *B. astarteoides,* and is closer to *Baeckea* (*Astartea*) *ambigua,* differing in the leaves, and the number of ovules in the cells. The species, together with *B. ambigua,* appears to hold an intermediate position between *Baeckea* and *Astartea.* I have not seen Niedenzu's work and therefore do not know what are his proposed limits to the genus *Baeckea.*

Balaustion microphyllum, Gardner, n. sp. Plate xxv. I-L.

Frutex parvus dense ramosus, ramis et ramulis erectis, ramis dense coopteris ex appressis imbricatis foliis. Foliis oppositis, erectis, decussatis, arcte imbricatis, orbicularibus, obtusis, concavis, aliquantulum carinatis, glandulare-punctatis, marginibus fimbriati-ciliatis.

Floribus 2, regulariter in superioribus axillis, super parvos tenues pedicellos. Bracteolis parvis, orbiculari-ovatis, acutis, carinatis et ciliatis. Calycis-tubo cylindrico-campanulato, piloso-glandulare, lobis semiorbicularibus, valde amplis et obtusis, fimbriatis. Petalis orbicularibus, intense cinnabarinis, ad apicem fimbriatis. Staminibus plurimis, filamentis parce planis, valde glanduloso-tuberculatis. Stylo staminibus longiore.

Frutex circ. 20 cm. alt.; foliis 1.3 mm. long. vel breviora. Bracteolae 1.5 mm.; calycis tubus 6 mm. long, 4 mm. lat. lobae .8 mm. long.; petala 2.5 mm. diam.

Hab. in distr. Austin pr. Koolanooka, in arenosis, fl. m. Sept. leg. (Hugo V. Throssell.)

A small shrub dense and bushy with erect branches and branchlets, the branchlets densely covered with crowded imbricate leaves. Leaves opposite, erect, decussate, closely imbricate, orbicular, obtuse, concave, somewhat keeled, glandular-punctate, the margins fimbriate-ciliate. Flowers in pairs, mostly in the upper axils on very short slender pedicels. Bracteoles small, orbicular-ovate, acute, keeled and ciliate. Calyx-tube cylindrical-campanulate, glandular-hairy, the lobes semi-orbicular, very wide and obtuse, fimbriate. Petals orbicular, intense scarlet, fimbriate at the tips. Stamens numerous, the filaments scarcely flattened, very glandular-tuberculate. Style longer than the stamens.

This striking little shrub appears to be worthy of specific rank. In the first place it has nothing of the habit of *B. pulcherrimum* which is prostrate or diffuse. The leaves are different as regards both shape and size, and in the manner in which they crowd and conceal the branchlets entirely. The flowers are much smaller, the bracteoles and calyx are not brightly coloured as in *B. pulcherrimum,* and the vestiture of the green calyx-tube with yellow viscid hairs has no counterpart in *B. pulcherrimum* as at present defined. The glandular filaments are also distinctive.

This plant would appear to be developed from *B. pulcherrimum* in a northern area isolated from the range of that species, and for this reason I have had some misgivings in proposing it as a distinct species, but according to the accepted conceptions of new species at the present time, these differences may be considered as specific.

The following species are regarded as synonyms:—

Casuarina horrida, Herbert, Proc. Roy. Soc., W.A. vii. 87 (1921).

This plant in no respect differs from *C. corniculata*, F. v. M.

Casuarina spinosissima, Gardner, l. c. ix. (part 1) 38 (1923).

I have now to regard this plant as a large form of *C. corniculata*, differing only in the larger cones and the longer and stouter spines. The shrub however is much larger and more virgate than the commoner form, the rigid branches being thick and glaucous. There are no differences, however, which could be taken as of specific value.

Casuarina leptotrema, Sp. Moore, Journ. Linn. Soc.—Botany, xlv. (1920) 193.

I have not seen any of Spencer Moore's material, but the distinctions given in his diagnosis are not of a character sufficient to establish a new species. *C. humilis* has commonly 4-6 teeth in the whorls, the size and proportion of the cones is somewhat variable, and the colour of the seeds is a very weak diagnostic character, depending upon the state of the cone in the specimens collected. For example, I have found both yellowish-brown and black achenes in one specimen of *C. corniculata*. The comparative width of the seed is also not a reliable characteristic. *C. leptotrema* is, in my opinion, only one of the numerous forms of *C. humilis*.

Adenanthos intermedius, Ostf. Det. Kgl. Danske Videnskab., Selskab., Biol. Meddel iii. 2.

This plant (Ostf. 674) is *Adenanthos barbigera*. It is true that the leaves are shorter and wider than the common narrow-leaved form prevalent in the hills near Perth, but the bracts, the flowers and the vestiture are exactly those of *A. barbigera*. Ostenfeld has pointed out that in appearance the plant is intermediate between *A. barbigera* and *A. obovata*, but the differences are superficial and do not apply further than the leaves. *A. barbigera* is not, as Ostenfeld states, confined to the Swan River district, but extends much further south.

Adenanthos intricata, Gardner, Proc. Roy. Soc. W.A. ix. (part i.) 39.

This plant in no respect differs from *A. argyraea*, Diels.

Dryandra teretifolia, A. Morrison, in Journ. Bot. 1912, l. 279.

There is a specimen of this plant in the Departmental Herbarium bearing a label in Morrison's handwriting. The plant is *Petrophila circinata*.

Pultenaea astipulea, Herbert, Proc. Roy. Soc. W.A. viii. 36 (1922).

This species is conspecific with *Phyllota Georgii*, Hemsl, but should perhaps be placed under *Pultenaea*.

Pomaderris Mayeri, Gardner, l. c. ix. (part i.) 41.

This is *P. Forrestiana*, F. v. M., the description of which was overlooked at the time of describing the plant.

Hannafordia Bissillii, F. v. M. var. **latifolia**, E. Pritzel, in Engler's Jahrb xxxv. 371.

What is probably this plant was described as *H. Kesselli*, Gardner in Journ. Roy. Soc. W.A. ix. 103, without reference to Pritzel's variety. *H. Kesselli* is specifically distinct from *H. Bissillii*, and therefore Pritzel's variety, which answers perfectly to the plant, hereby becomes a synonym. Pritzel appears to have overlooked the floral distinctions, establishing his variety on habit and leaf alone. Owing to this omission, *H. Bissillii*, var. *latifolia*, was not acknowledged when *H. Kesselli* was described.

Melaleuca coronicarpa, Herbert, Journ. Roy. Soc. W.A. viii. (1922) 35.

This appears to be one of the forms of *M. cardiophylla*. I can detect no differences which might be accounted specific. The only constant difference is that the style is short in *M. cardiophylla*, while Herbert states that the style is almost as long as the stamens in his plant. The var. (?) *longistaminea*, F. v. M., with its quite different habit and much larger green flowers, is perhaps worthy of specific rank.

Duboisia Campbelli, Morrison, in Journ. W.A. Nat. Hist. Soc. iii. 15 (1905).

This plant, a specimen of which is labelled in Morrison's handwriting, agrees perfectly with his description, but is wrongly placed. The plant is *Eremophila saligna*, Sp. Moore.

EXPLANATION OF PLATES.

PLATE XXIV.

Casuarina fibrosa, Gardner (A—F).

A. Branchlet—nat. size; B. Branchlet (enlarged); C. Cone; D. Dorsal view of bracteole and appendages; E. The same with the appendage removed; F. Achene.

Banksia audax, Gardner (G—J).

G. Leaf; H. Perianth; I. summit of style; J. ovary and stipes.

Banksia violacea, Gardner (K—O).

K. Leaf (upper surface); L. lower surface of leaf; M. transverse section of leaf N. Perianth; O. stigma and portion of style.

PLATE XXV.

Dryandra erythrocephala, Gardner (A—H).

A. Leaf (upper surface); B. Leaf (lower surface); C. upper part of leaf (under surface, enlarged); D. leaf-section; E. and F. Bracts; G. Perianth; H. limb.

Balaustion pulcherrimum, Gardner (I—L).

PLATE XXVI.

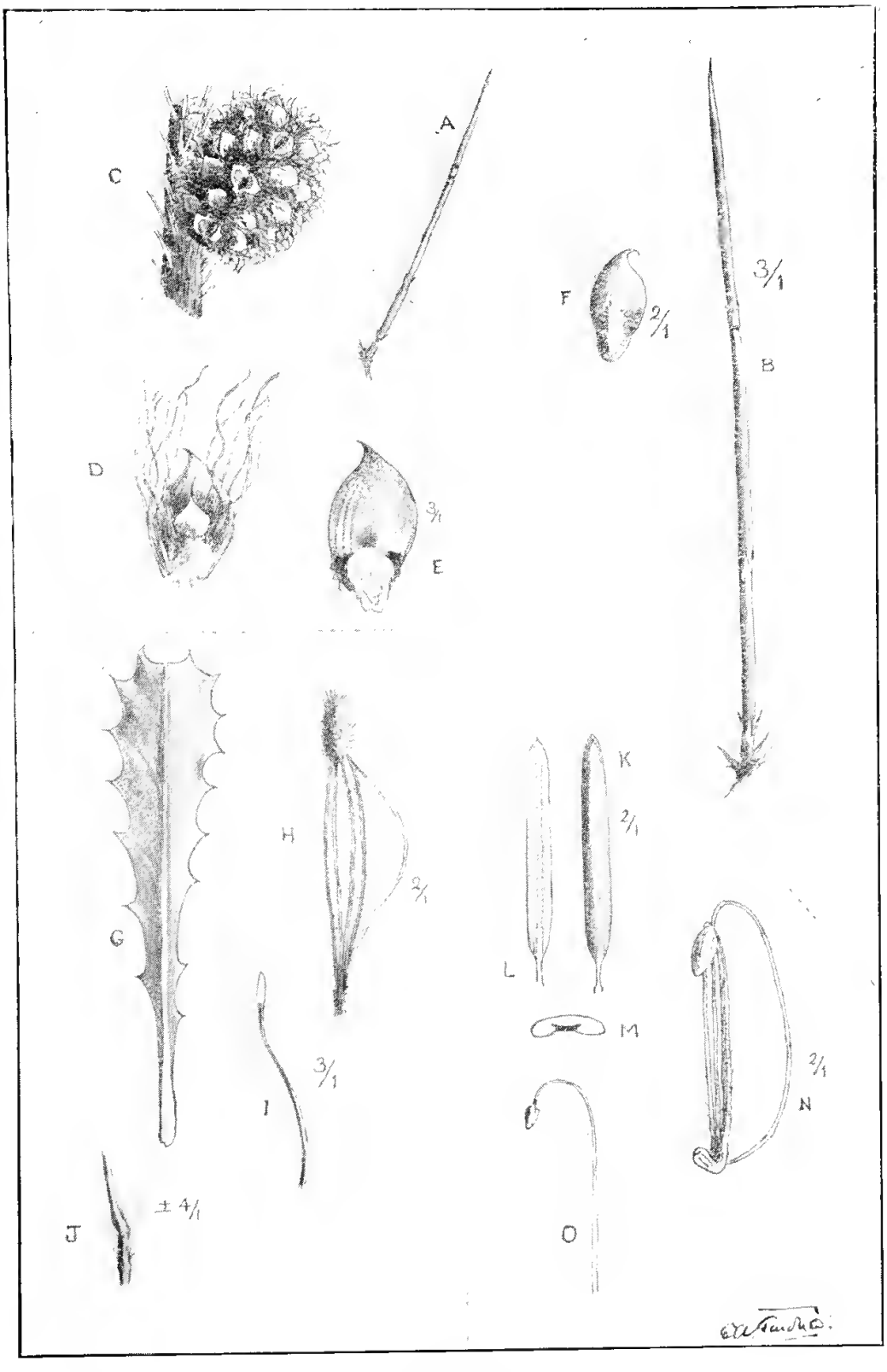
Baeckea muricata, Gardner (A—D).

A. Branch; B. Leaf; C. Flower with two petals removed; D. Stamens.

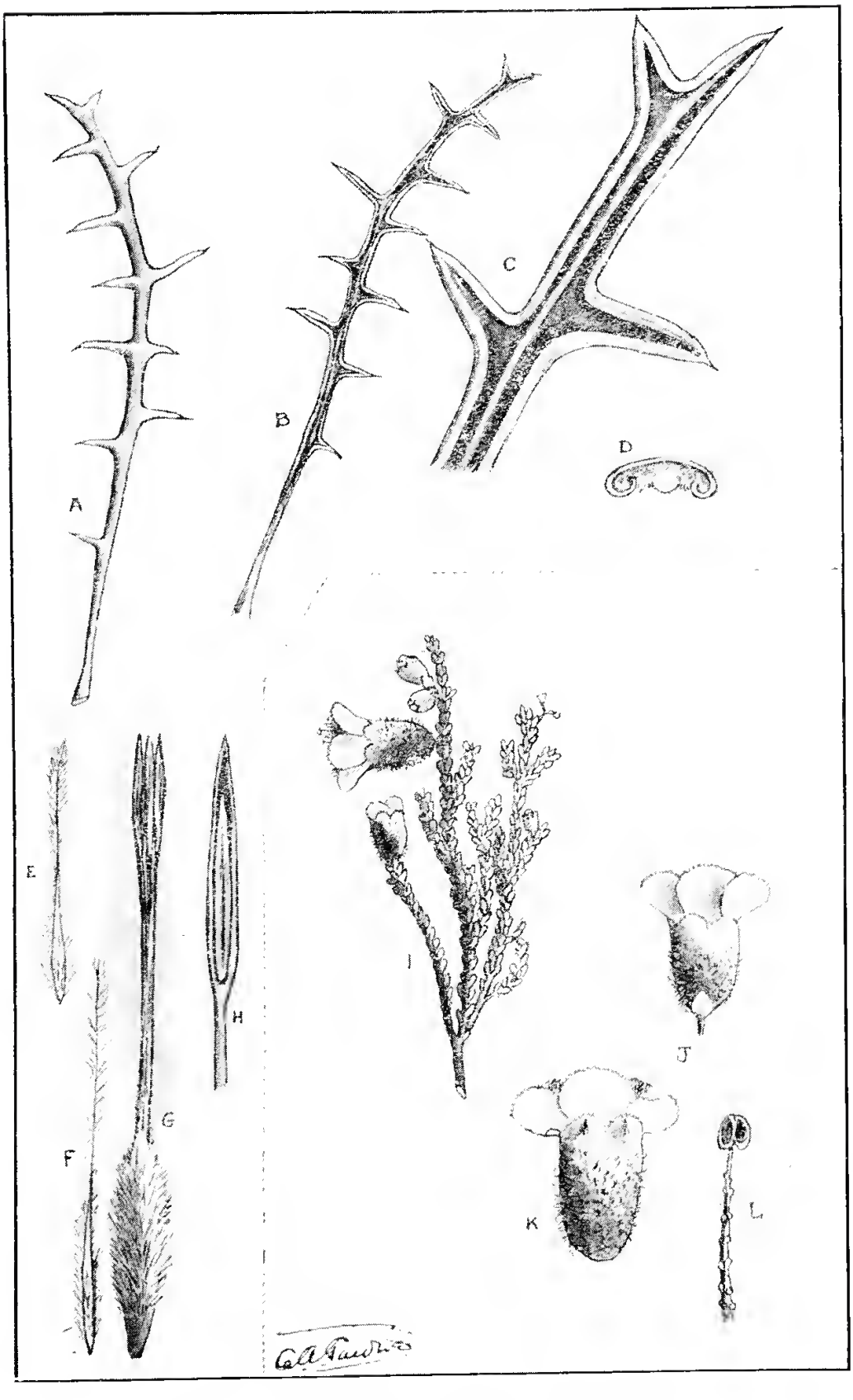
PLATE XXVII.

Astartea heteranthera, Gardner (A—D).

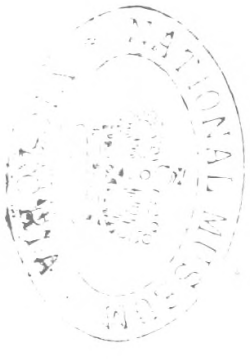
A. Branchlet; B. Flower with two petals removed; C. Staminal bundles; D. longitudinal section of ovary.



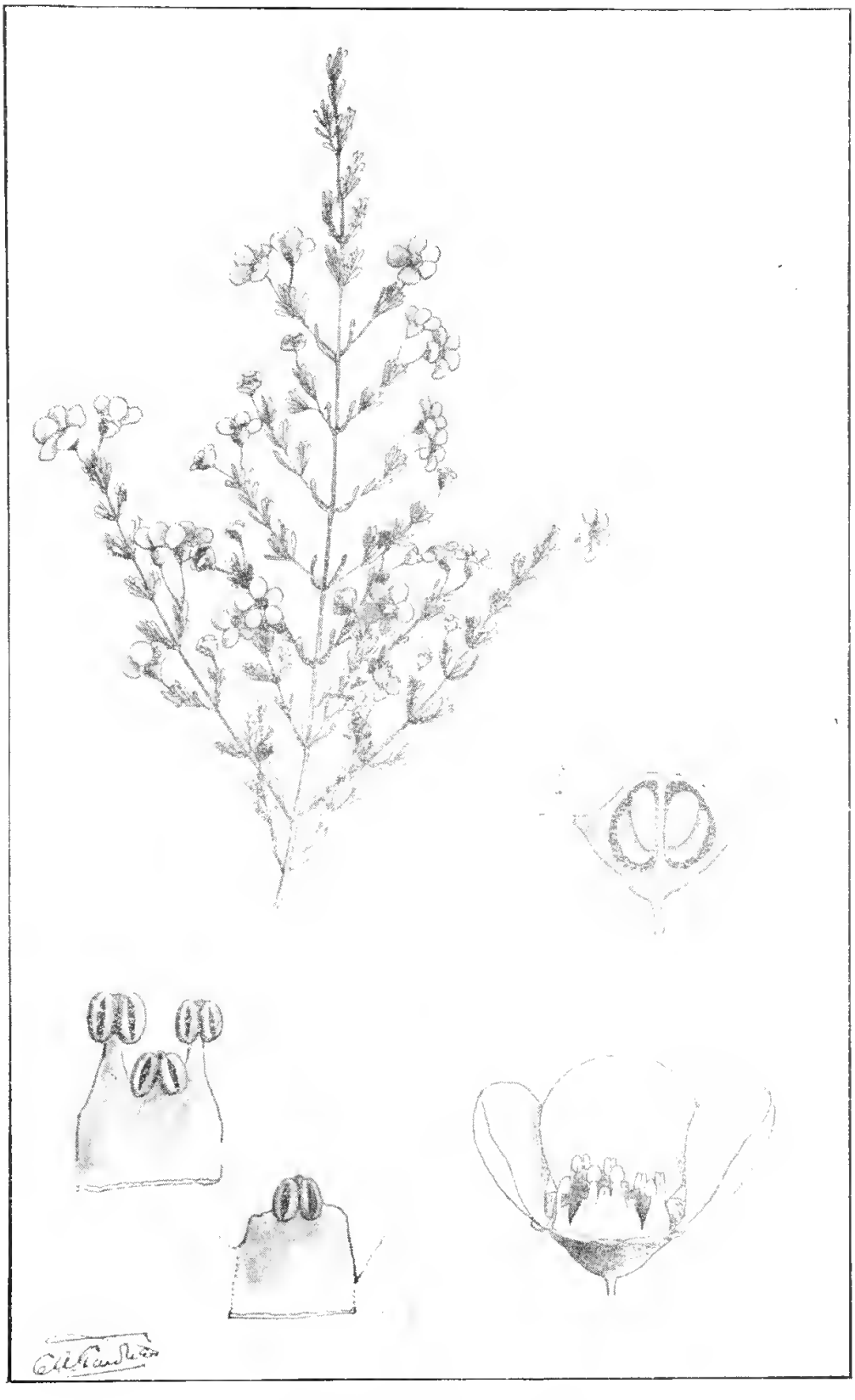
A-F. *Casuarina fibrosa.*
G-J. *Banksia audax.*
K-O. *Banksia violacea.*



A-H. *Dryandra erythrocephala* Gardner.
I-L. *Balaustion microphyllum*, Gardner.



Baeckea muricata. Gardner.



Astartea heteranthera. Gardner.

5.—ON THE EVOLUTION OF THE NEW STAR, "NOVA PICTORIS,"

(With One Figure, 7.)

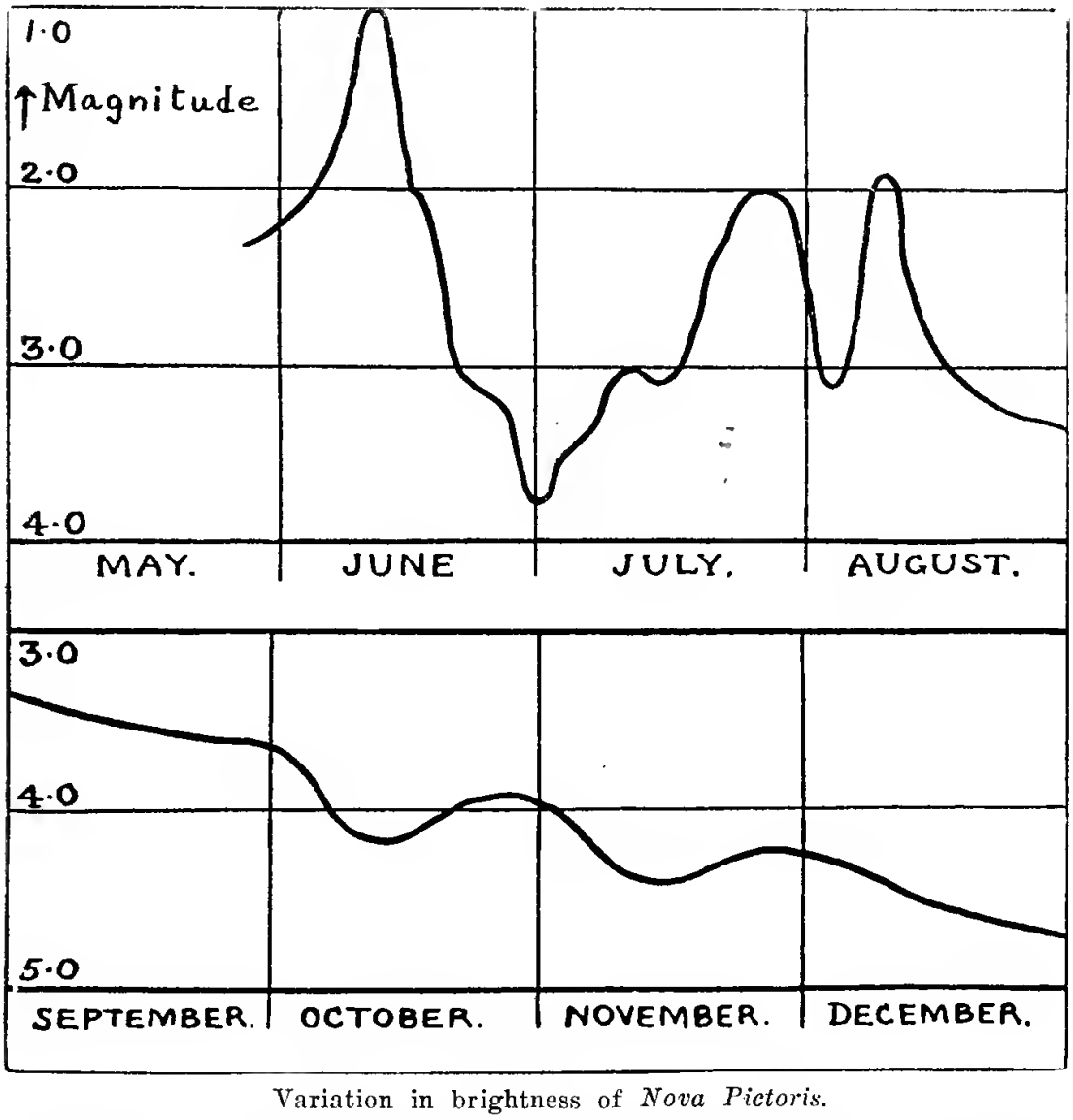
By Professor A. D. Ross, M.A., D.Sc., F.R.S.E.

(Read 14th September, 1926; Published 24th October, 1927.)

Nova Pictoris was discovered on 25th May, 1925, by R. Watson, of Beaufort West, South Africa. The star, which is situated at R.A. 6h. 34m. 57s., Dec. 62° 34′ 34″ S., was of magnitude 2.4 at the time of its discovery,[1] and apparently of magnitude 12.75 prior to its outburst, which must have commenced many weeks before the discovery.[2]

On June 9th of last year I contributed to a meeting of this Society a preliminary note dealing with my observations of the brightness of the Nova in the period from May 28. During the remainder of the year 69 fur-

Fig. 7.



Variation in brightness of *Nova Pictoris*.

ther estimates of brightness were made, and the observations give the curve shown in figure 4. It will be seen that the first maximum was not attained until June 10 when the star was of 1.0 magnitude. This period of two and

a-half weeks during which the Nova was under observation and still brightening is specially valuable in formulating a theory of novae. From June 10 to July 1 there was a fairly steady decline in brilliance to 3.7 magnitude, followed by a less regular increase to subsidiary maxima of 2.0 and 1.9 mag. about July 26 and August 9. From August 9 a marked decline set in which, except to a slight extent in October and November, did not show the periodic fluctuations which have been characteristic of so many novae in their declining stage. By the end of 1925 the star had fallen to about 4.7 mag. and was still, but very slowly, fading.

These photometric studies are of great interest when considered along with the changes in the star's spectrum. Immediately after the discovery the spectrum of the Nova was that of an ordinary F type star,[3] and there was little variation until about June 7. The spectrum showed absorption lines due to iron, titanium, scandium, vanadium, chromium, yttrium, etc., and a Doppler displacement indicated a relative velocity of approach of the star of about 70 kms. per second.[4] As the brightness of the star had increased three-fold during the period of constancy of spectrum from May 25 to June 7, we must consider that the surface portion preserved the same physical conditions of temperature, etc., while the surface area extended, so as to produce the increased total luminous radiation. About the period of the first maximum of brightness marked changes occurred in the spectrum; new lines appeared, a bright band spectrum developed, and the original lines broadened towards the violet and became diffuse and finally gave rise to a set of lines showing a Doppler displacement corresponding to approach at 300 kms. per sec. with traces remaining of the original lines displaced for 70 kms. per sec. By the middle of June the hydrogen lines in the spectrum had a peculiar displacement towards the violet, suggesting radiating atoms approaching at a speed of about 1,200 kms. per sec. As the brightness of the Nova waned, the spectral lines grew sharper, and the spectrum reminded one of Eta Argus, while the nebular bands at 4363 and 4641, which are characteristic of most novae in their latter stages, were very tardy in developing.

These observations appear conclusive against the outburst being due to a collision between the star and a nebula, or between the star and another star, or to a planetary body falling into the star. In all such cases we should have surface generation of heat with immediate variations in the spectral type. A collision between a star and other matter might well produce a sudden increase in luminosity, and one which would be merely transient if the new material did not penetrate deeply into the star, but the spectrum would immediately change to an earlier type. Such a collision could explain the ephemeral accession of luminosity in the case of Beta Ceti in 1923,[5] but it cannot apply to the case of Nova Pictoris. Increasing brightness with constancy of spectral type must imply increase in radiating surface. The star must have grown as regards surface area, and therefore as regards volume. The observations clearly point to an internal generation of energy; a convulsion of great violence in the central part of the star. In the course of a few days the photosphere was pushed outwards by the internal explosion, and only after the lapse of many days did the rapidly outward moving matter reach the surface and reveal itself by a greatly enhanced Dopler effect. We can only speculate as to the nature of the internal explosion, but evidently there was some violent disturbance of physico-chemical equilibrium in the interior. We have reason to believe that in stars elements exist

which are heavier than any known terrestrial chemical elements, and it is probable that these undergo radio-active disintegration. It seems possible that, under the extreme conditions existing deep in the interior of a star, such disintregration may occur with explosive violence, thus accounting for the phenomena presented by Nova Pictoris.

The peculiar behaviour of the hydrogen lines in June, 1925, is suggestive. These lines indicated a radial speed of about 1,200 kms. per sec. It has recently been pointed out by Milne[6] that, under the joint action of radiation pressure and gravitation, atoms which from some cause or other begin to move outwards with appreciable speed from a star will be accelerated towards a limiting velocity whose magnitude will be of the order of the 1,200 kms. per sec. velocity mentioned above. Possibly the noted large displacements of the hydrogen lines in the spectrum of Nova Pictoris are to be ascribed to such accelerated escape.

Finally, from the increments in brightness of the Nova and the augmentation in the Doppler effect of the main spectrum lines, one can calculate the diameter of the star. This known, and assuming the radiation to be that of a normal A type star—which the Nova resembled at its maximum—we get the absolute magnitude and distance of the star. The latter works out at about 450 light years. (It will be remembered that the distance of Nova Persei was estimated at about 250 light years.[7]) As the value 450 is quite plausible, it may be taken to lend some support to the hypothesis outlined above to account for the outburst.

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6.—THE PHYSICAL PROPERTIES OF MANGANESE STEEL.

By Professor A. D. Ross, M.A., D.Sc., F.R.S.E., F.Inst.P.

(With Two Plates—xxviii.-xxix.)

(Read 14th September, 1926; Published 24th October, 1927.)

The remarkable magnetic properties possessed by an alloy of 75 per cent. iron and 25 per cent. nickel were pointed out in 1899 by Hopkinson.[1] It was shown that such an alloy was non-magnetic at room temperature, but if cooled down in a freezing mixture to below —20°C., it became magnetic and remained magnetic while the temperature was raised to nearly 600°C. Iron and nickel form, as the freezing point curve shows, a series of homogeneous solid solutions and a compound, probably Fe_2Ni[2]. The temperature of the β—α magnetic inversion (Ar_2) of iron is lowered by the addition of nickel, and that of nickel is raised by the addition of iron. All the alloys with less than 25 per cent. nickel have two transformation or critical temperatures, the points Ar_2 and Ae_2 being distinct and giving a certain hysteresis of the magnetic transformation. In the case of the eutectoid alloy with 25 per cent. nickel, the lag in the transformation temperature is about 600°C.

Investigations made in 1910 by J. G. Gray and the author indicated that manganese steels showed somewhat similar properties. Various causes delayed the full investigation of this subject, and so the present paper summarises results obtained over a period of some 15 years.

Manganese has become a highly important element in connection with the metallurgy of steel, and so the results of the researches have enhanced in value. It was in 1774 that Gahn isolated the metal manganese, but it was the experiments of Mushet in the middle of last century which resulted in the addition of manganese to Bessemer's blown metal to produce a very tough and workable steel. Sir Robert Hadfield in the year 1883 was the first to show that a steel containing 12 or 13 per cent. of manganese with 1.0 to 1.5 per cent. of carbon was practically non-magnetic, and that quenching rendered it remarkably tough instead of hard and brittle.

The tests to be described have been carried out on a graded series of steels specially prepared by Sir W. G. Armstrong, Whitworth & Co., and with a manganese content varying in steps from 0.2 per cent. to 12.5 per cent. The carbon content was almost constant at 0.7 per cent., and the sulphur at 0.02 per cent., while with increasing manganese the silicon rose from 0.1 to 0.5, and the phosphorus from 0.012 to 0.05 per cent. The silicon and phosphorus increased through being added as an impurity in the manganese, but tests carried out by J. G. Gray and the author[3] show that such variation would not appreciably affect the magnetic properties of the steels.

The peculiarities in the magnetic behaviour of the steels begin to grow marked with a manganese content of about 6 or 7 per cent. After annealing a specimen of such steel at 900°C., the material gives an intensity (I) of magnetisation of only 72 c.g.s. units in a field (H) of 50 gauss. When the metal is lowered to the temperature of liquid air (about —190°C.) we obtain a value of I of 212 for the same applied field $H = 50$. On warming up to room temperature we find that the value of I is now 342 for H = 50, and, if the cooling and heating have been sufficiently slow, the material is completely reversible, with I varying between 342 and 266 as the temperature is altered from 15° to —190°C. The liquid air treatment has thus resulted in transforming the specimen from a feebly magnetic state to one of good magnetic quality. In the final condition the effect of immersion in liquid air is that found in ordinary carbon steels,[3] viz., a reduction of the susceptibility for low and medium fields, and an increase for fields exceeding $H = 250$ when the specimen is cooled from 15° to —190°C. If we define the magnitude of the transformation which has been brought about in the annealed steel by the liquid air treatment as the percentage by which the final exceed the initial susceptibilities corresponding to room temperature, we get the following results for various values of the applied magnetising field.—

Applied field	5	10	20	50	100	gauss.
Transformation	375	300	260	230	205	per cent.

When the manganese content is as low as 1 per cent., no measurable change in magnetic quality is brought about by the liquid air treatment of the annealed metal. With increasing content to 6.5 per cent. manganese the transformation increases steadily in amount, but afterwards falls off slowly as the manganese is raised to 10 per cent., and more rapidly with further increase to 12.5 per cent. Steels containing 10 per cent. and more of manganese are only feebly magnetic in the annealed condition.

It is interesting to note that manganese steels with more than 2 or 3 per cent. of manganese are more magnetic at somewhat elevated than at ordinary temperatures. Thus, in a field $H = 20$, an annealed 6.5 per cent. manganese steel had an intensity of magnetisation (I) of 16 at 15°C., 25 at 230°, 31 at 490°, 125 at 630°, and 55 at 670°C. For $H = 100$, the corresponding values of I were 139, 146, 153, 282, and 112. This steel became non-magnetic when a temperature of 725°C. was attained. In the transformed state the same phenomenon is observed. Thus for $H = 20$ we have I 80 at 16°C., 110 at 210°, 123 at 320°, 150 at 460°, 290 at 610°, 300 at 660°, and 103 at 690°, while for $H = 100$ I at the same temperature takes the values 576, 660, 750, 730, 650, 485, and 238. This transformed steel becomes non-magnetic when heated to 730°C.

Much of the apparently anomalous behaviour of the manganese steels may be satisfactorily explained if we consider the influence of manganese on the iron-carbon system. Manganese is isomorphous with gamma-iron and forms solid solutions with it.[4] Thus the addition of manganese to a carbon steel has the effect of retarding the inversion of the non-magnetic gamma-iron into magnetic alpha-iron. A manganese steel under ordinary conditions will therefore to some extent exhibit the structure which would be obtained by the ideal quenching of a carbon steel at a temperature of, say, 900°C.,

that is, at a temperature at which it would consist of a solid solution of carbon or carbide of iron in gamma-iron.[5] The term austenite is commonly applied to this solid solution and will be employed here for the sake of brevity. The addition of the manganese, however, does not completely suppress the inversion at temperature Ar_2 into alpha-iron, just as the actual quenching of a carbon steel will not altogether stop the change into magnetic iron. Consequently a manganese steel after ordinary treatment will consist partly of non-magnetic gamma-iron and partly of magnetic alpha-iron, the amount of alpha-iron present being less the greater the manganese content—other conditions being identical. On the whole, therefore, the manganese steel is less magnetic than a simple carbon steel with the same relative proportions of iron and carbon. But the managanese steel is not in a true equilibrium condition. The gamma-iron which it contains is not stable at ordinary room temperature, and has only had a quasi-stability conferred upon it by the presence of the manganese. But for this restraining factor the gamma-iron would all have been converted into alpha-iron at a temperature of about 730°C. for a steel containing about 0.7 per cent. carbon. The further we cool the steel below this temperature, the less is the metastability of the austenite and the more of this phase will undergo inversion. The transformation from austenite into pearlite (the well known eutectoid constituent of ordinary steels) is not direct, the material passing through certain intermediate stages of resolution, which, as they exhibit characteristic microstructures, have had distinctive metallographic names given them. The more important transition stages are hardenite, troostite, and sorbite. The first of these is a non-magnetic condition, but the last is decidedly magnetic. The feeble magnetism of the 6.5 per cent. manganese steel is therefore explained if we can show that iron is retained to some extent in the gamma condition down to room temperature, that is to say, if the annealed steel exhibits a martensitic structure. This, as will be shown later, has been found to be the case. We shall also expect the intensity of magnetisation of this steel for any definite applied field to be zero about 730°C. Thereafter, if the steel be cooled to any temperature t°C., and tested at a fixed temperature T°C. (not less than t), the value of I as measured at T° will be greater the lower value of t. That this is in strict agreement with fact is shown by the following table of the values of I for $H = 100$:—

T°C.	t°C.	I.
15	15	139
15	0	257
15	—190	576

Similar results were obtained for the steels with manganese content less than 6.5 per cent., but when the amount of manganese became as low as 1.5 per cent. the steels showed very little evidence of transformation at all. The effect was also marked in steels with more than 6.5 per cent. manganese until the manganese content became so large as to leave the metal almost non-magnetic in all conditions.

In order to show that the transformation effected by the liquid air treatment was produced by the conversion of gamma into alpha iron, specimens of the annealed steel were examined under the microscope before and after cooling to —190°C. Some of the photomicrographs obtained are shown in the accompanying plates. For etching, a one per cent. solution of nitric acid in alcohol was employed and gave satisfactory results.

With all the steels containing less than about 1 per cent. of manganese, both before and after cooling to —190°C., the steel consisted of a pearlite groundmass and alpha-ferrite filaments; that is, alpha-iron without any gamma-iron, and hence no transformation was to be expected in the magnetic tests.

Plate xxviii., figs. 1 and 2, are micrographs of a 1.32 per cent. manganese steel. Both exhibit the same general type of structure, viz., massive pearlite and alpha-ferrite filaments. The pearlite in the annealed specimen is not, however, so well laminated as we find it in an ordinary carbon steel. It is rather of a sorbitic nature, that is to say, it is the decomposed austenitic solid solution which has not been completely resolved into pearlite. The manganese is showing in this case its power to check the conversion of gamma- into alpha-iron. After cooling to —190°C., the pearlite is better laminated, that is, the metastability shown in the sorbitic structure has been almost entirely removed and the resolution into true pearlite is now practically complete. As the sorbitic and the laminated pearlite both consist of alpha-iron there is no distinct difference in the magnetic quality of this steel before and after cooling to —190°C.

Plate xxviii., figs. 3 and 4, are photomicrographs of a steel containing 2.57 per cent. of manganese. Again we have a structure containing alpha-ferrite and pearlite. In the annealed specimen, however, the pearlite is all sorbitic and there is a distinct indication of the needle-shaped structure which is characteristic of martensite (non-magnetic gamma-iron). The pearlite shows both dark and light shading, and there is very little free ferrite. After the cooling to —190°C., the specimen in its transformed condition exhibits quite a different structure. The martensitic appearance is not noticeable, and a transition product—probably troostite—appears as minute dark amorphous patches. The iron is now therefore entirely or almost entirely alpha-iron, and hence the magnetic susceptibility of the steel is augmented by the transformation of the original admixture of gamma-iron into alpha-iron.

Plate xxix. shows the microstructure of a 6.50 per cent. manganese steel. In the annealed specimen the chief feature is the interlaced structure of acicular martensitic constituents (gamma-iron). The white groundmass is partly the manganese carbide with any free gamma-iron. It will be observed that the martensitic needles orient themselves so as to build up a pattern of more or less perfect equilateral triangles. The broad dark bands are very possibly composed of hardenite (which contains no alpha-iron). After the specimen has been immersed in liquid air it presents a very marked change of structure consisting of a treble formation. The white patches are almost completely freed alpha-ferrite. The main groundmass is the double carbide $(MnFe)_3C$ with some partially undecomposed hardenite which is most probably in the transition form of troostite, showing as a few minute black dots.

Plate xxviii., figs 5 and 6, give the appearance of a 9.87 per cent. manganese steel. In the annealed state about 80 per cent. is a groundmass of a solid solution (austenite: gamma-iron). There are also minute blue segregations —probably manganese sulphide—with which are associated amorphous black patches of troostite. After cooling to liquid air temperature, the solid solu-

tion is largely decomposed, and, as a result, much of the original gamma-iron is now found in the form of troostite (alpha-iron). This specimen, therefore, although always feebly magnetic shows the same type of transformation as the 6.50 per cent. manganese steel.

If the hypothesis is correct that the magnetic transformation of the manganese steels produced by cooling to liquid air temperature is representative of a transition from austenite and hardenite (both containing gamma-iron), then a carbon steel ideally quenched at 900°C., or above that temperature, should show precisely the same kind of effect. This will be evident if we consider the structure of such material. A high carbon steel, after quenching at about 1,100° C., shows polyhedral austenite with hardenite needles, and there is little or no magnetic iron present. The steel is in this condition only very feebly magnetic. A considerable transformation is, however, effected by immersion of the specimen in liquid air, as will be seen from the following table, giving the results of tests carried out at 15°C.:—

	Intensity of Magnetisation, I.	
	$H = 40$.	$H = 200$
Before Liquid Air Treatment	84	487
After Liquid Air Treatment	100	635

This test seems to establish the accuracy of the theory advanced above to account for the curious transformations occurring in manganese steel.

The investigations described in the foregoing throw considerable light on the origin of many of the remarkable properties of manganese steel. The alloy is one in which the heat treatment is all important, and by proper variation of this treatment the alloy can be adapted to a very wide variety of purposes. In the toughened condition a tensile strength rising to 60 or even 70 tons per square inch is obtainable, with a ductility indicated by an elongation of 50 to 68 or 70 per cent. The remarkable feature is that resistance to wear by abrasion increases with the severity of the service to which it is applied, because the slightest deformation of the steel is accompanied by a considerable increase in hardness. Its use for tramway and railway points is at once indicated, as indeed is its application in all cases where toughness and ductility are called for in steel. In the early days of the use of manganese steel, failures may have been experienced, but these undoubtedly were due almost entirely to ignorance of the proper heat treatment. Now that the heat treatment and its effect upon the structure and constitution of the alloys have been determined, a wide extension of the employment of this special steel is certain, and countries possessing deposits of manganese free from deleterious impurities have a valuable asset.

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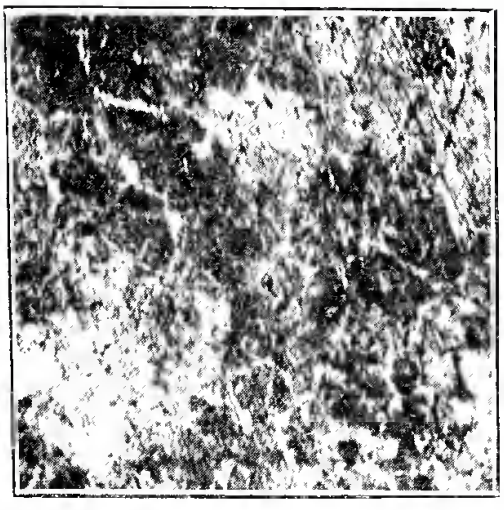

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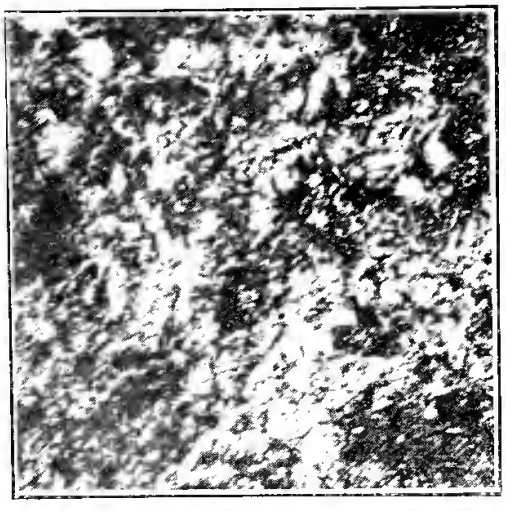
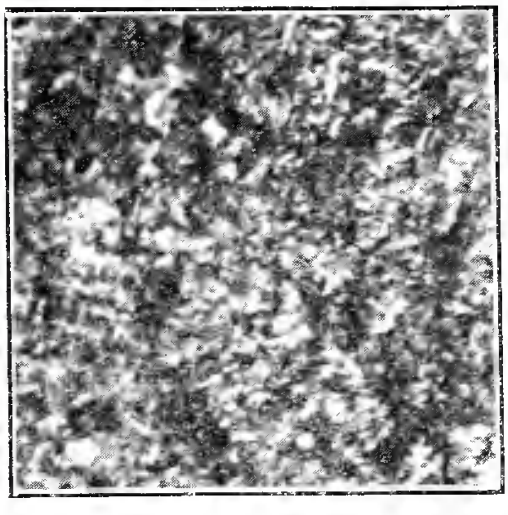


Fig. 1. 1.32% Mn. Fig. 2.



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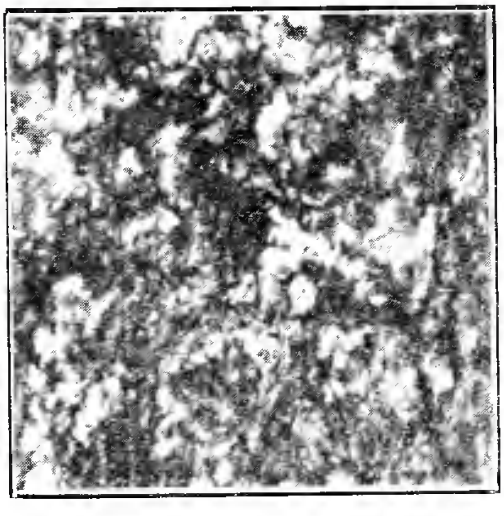

Fig. 3. 2.57% Mn. Fig. 4.

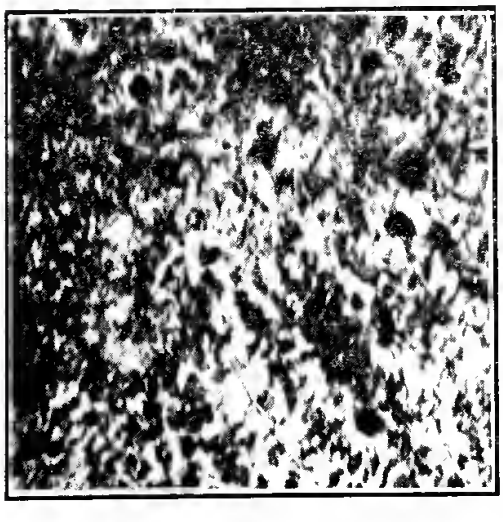

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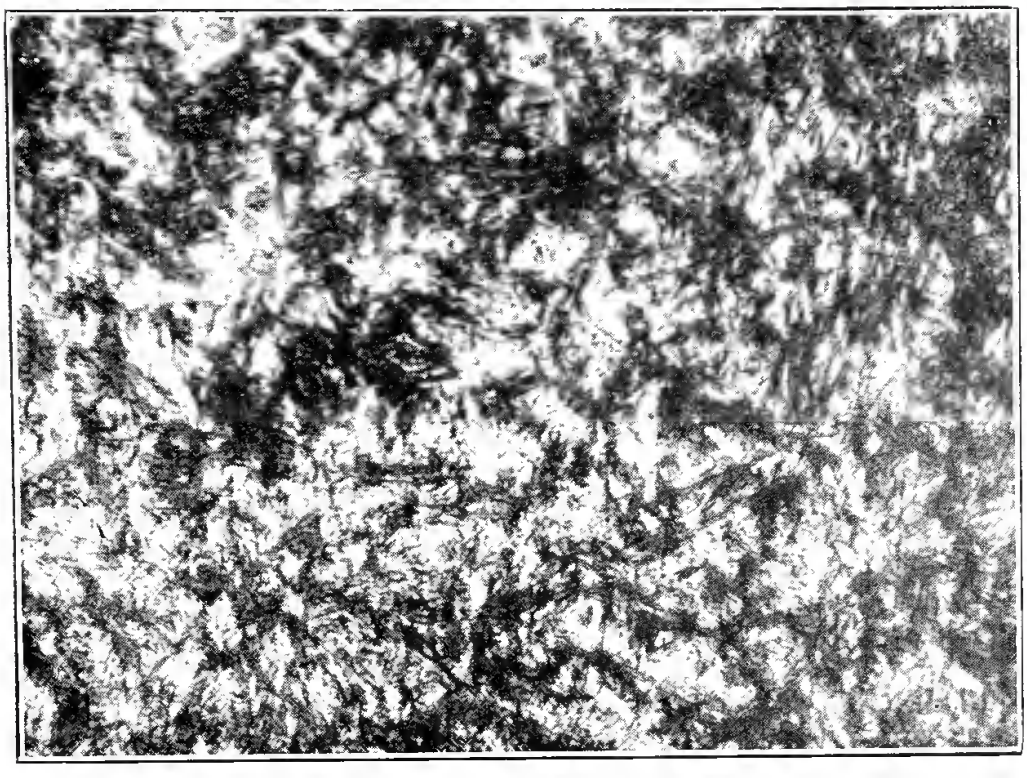
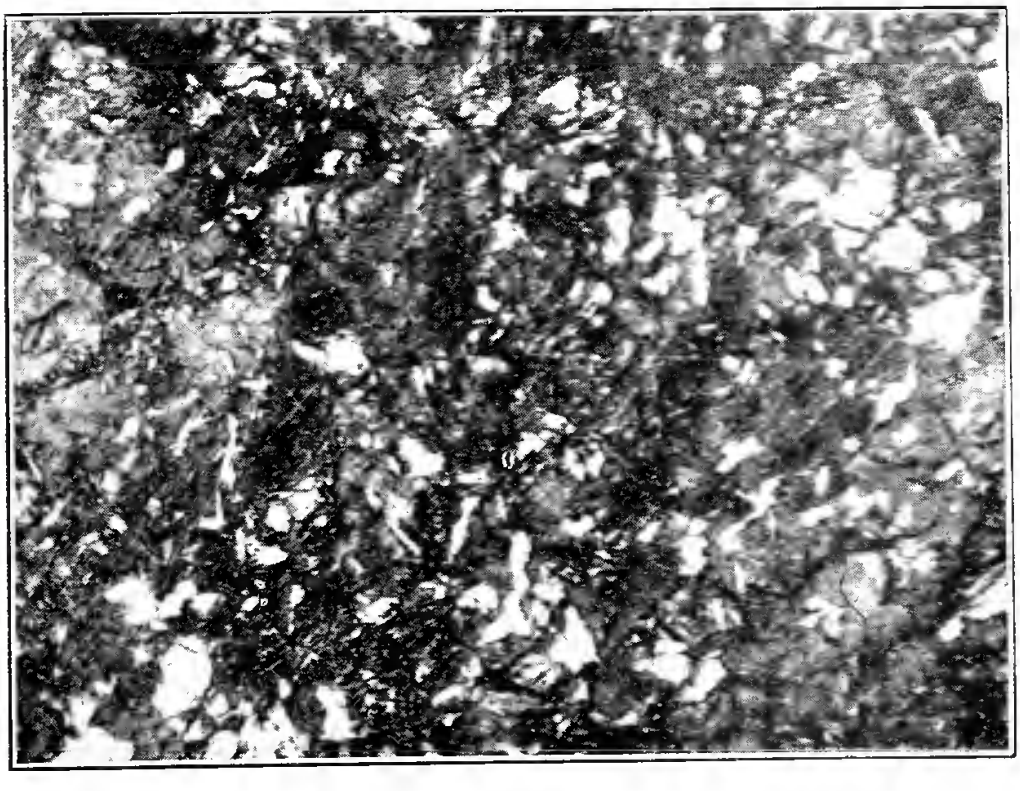
Fig. 5. 9.87 %Mn. Fig. 6.

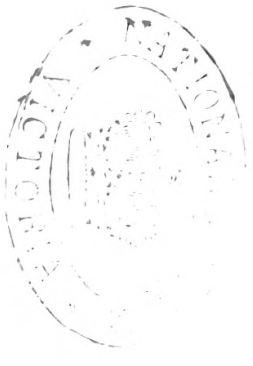
Photomicrographs of Manganese Steels. x200.



6.50% Manganese Steel. Annealed. x750.



6.50% Manganese Steel. Transformed. x750.



7.—THE VOLCANIC HISTORY OF WESTERN AUSTRALIA.

PRESIDENTIAL ADDRESS

By

A. Gibb Maitland.

(Delivered on the 12th July, 1927; Published October, 1927.)

"To discover order and intelligence in scenes of apparent wildness and confusion, is the pleasing task of the geological inquirer."

General.

The Report of the Council, together with the Treasurer's Financial Statement and other items of interest relating to what may be called the business side of the Society's transactions, which have already been submitted to you, render it quite unnecessary for me, as your President, to make any further allusion to the material aspects of your affairs.

Australasian Association for the Advancement of Science.

I feel that I should be wanting in my duty to you and to the very broad domain of science, were I at the outset of this evening's proceedings to pass over without notice the most important event in the scientific world of Western Australia during the Royal Society's year which has just closed, viz., the visit of the Australasian Association for the Advancement of Science to the State in the months of August and September last. This being the first time that the Association has met on the western seaboard of the continent, the meeting consequently marks an epoch in the development of science in Western Australia. That the Association should have decided to hold its eighteenth meeting in Perth, so far removed from Australia's chief centres of population, is a compliment to the State and a distinct recognition of the efforts of the relatively small band of scientific workers in this large, young, and, as yet, comparatively undeveloped country. The liberal financial and other assistance given by both the State and Commonwealth Governments and private individuals towards the visit of the Association is a matter for gratification. We, as the premier scientific society in Western Australia, are not unmindful of this and appreciate to the full the aid thus afforded.

The public welcomed the visiting members of the Association with characteristic cordiality and hospitality. The meeting was favoured with good weather, and as the carefully-considered programme left little to be desired, the visiting scientists carried away with them very pleasant memories, whilst socially the meeting proved to be everything that both guests and hosts alike could have wished.

The Modern School, where the meeting was held, proved very satisfactory; it would, in fact, have been difficult to find at the time a building and grounds better adapted for such a rendezvous.

The various sections, fifteen in number, were well attended, many valuable papers were read, and several important intersectional discussions on scientific problems took place. The sectional meetings offered so many subjects of absorbing interest that it would be difficult to say which proved the most generally attractive.

The excursions were all that could be expected of such enterprises. They were well managed, ably led, and presented a wide range of instructive scientifie phenomena.

As far back as January, 1907, it was pointed out at the Adelaide meeting of the Association that "the civilising value of scientific investigation such as is evidenced by a gathering of this kind, where the men from the East meet those from the West upon common ground for the purpose of discussing and recording the work of the past, must tend to link all parts of the continent together, and time will perhaps show that it may fall to the lot of the Australian men of science to materially assist in the solution of the problem of preserving those harmonious relationships and in the strengthening of those ties which are so severely taxing the combined resources of political diplomacy." It is for others to judge as to the extent to which the brotherhood of science has played through the visit of the Australasian Association for the Advancement of Science to the State, in promoting an *entente* destined to be of lasting benefit to Australia, in addition to acting as a much needed stimulus to the local development of scientifie inquiry.

THE VOLCANIC HISTORY OF WESTERN AUSTRALIA.

In the address which it was my privilege to lay before you at our last Anniversary, 12 months ago, I gave, though only in the very briefest outline, what seemed to me the main contributions which Western Australia has made to the general principles of geological science.

Within the limitations imposed by the traditional requirements relating to the address of a retiring President, I purpose on this occasion taking up a portion of that narrative and devoting a very short period to a review of the present condition of our knowledge of the volcanic history of Western Australia.

Igneous action has played a very important part in the geological history of the State for the evidences of volcanicity have been manifest over a protracted interval of geological time, and none ranks higher in importanee and general interest. The main groups of igneous rocks are represented over widely separated areas, both amongst the intrusive and extrusive rocks of different geological ages; the earliest beginnings go back into the Archaeozoie period, and the final manifestations did not cease until late Tertiary or perhaps later times. The volcanic history of the State thus divides itself into two widely separated periods. The first embraces the vast Palaeozoic and Archaeozoic ages, whilst the second falls entirely within the Tertiary period. Between these two periods is the prolonged interval of Mesozoic time during which, so far as investigations have been carried, no trace of contemporaneous volcanic action is known. In this respect Western Australia only illustrates that general quiescence of volcanic energy which finds a striking parallel in other regions of the globe, more especially over the greater portion of the European continent. The subject of igneous action in Western Australia is important, not only from the more or less local interest which attaches to its various manifestations, but also from the fact that its geological history involves much that is fundamental to the science generally, besides

being of considerable value, for nearly all the ore deposits have a very intimate connection with igneous rocks, and their differentiates while the decay of many of them results in the formation of rich soils. The known mining districts in Western Australia and elsewhere occur in the immediate vicinity of igneous rocks, or in those areas in which the chief characteristics point to prolonged volcanic activity in its many forms and of varying degrees of intensity.

The volcanic products are, according to their mode of origin, divisible into two main groups; some were formed from congealed molten matter, which forced its way either along the planes of bedding or across the strata in the form of intrusive sheets or dykes, whilst the others were contemporaneous with the deposition of the associated sedimentaries and include outpourings of lavas, ashes, and other volcanic ejectmenta thrown out from numerous and widely separated centres of eruption, of which the remains at present exist, submerging fairly large areas of country.

The volcanic rocks have been investigated from the stratigraphical, petrographical, and chemical sides and a vast amount of data made available, chiefly through the official publications of the Geological Survey and the Chemical Branch of the Mines Department.

The interpretation of the volcanic history of Western Australia is only possible after the true order of succession of the rocks, which have preserved the memorials of igneous activity from the earliest of geological times, has been arrived at. As the later of the geological periods the record ought, under ordinary circumstances, to be the easiest part of the State volcanic history to interpret, for the reason that the conditions being less remote from those prevailing at the present day, have suffered far less destruction and transmutation than those of the older geological periods.

In the extreme South-Western portion of the State evidence of extensive basaltic eruptions of Miocene Tertiary Age cover an area of about 3,000 square miles.

The basaltic flows, when of sufficient thickness, cracked during cooling into characteristic columns or forms; they weather out into steps along their vertical joints, and their terraced outcrops are to be seen in the low-lying land on the seacoast at Bunbury and elsewhere on the South Coast. The basaltic rocks of Bunbury are exposed as a narrow fringe for about a mile along the shore, with a width of about 100 yards, and in no place do they rise more than a few feet above high water mark. One of the lava flows proved, as determined by boring operations at the Bunbury Brewery, to be 97 feet thick. It was pointed out by Mr. F. J. Gregory, in the year 1861, that basalt again made its appearance about four miles to the South of Bunbury, at 20 miles it was exposed in the bed of the Capel River, and finally cropped out in a continuation of the same line on the South Coast to the Eastward of Flinders Bay. The Bunbury basalt and its south-easterly extensions, in the valley of the Blackwood River, and near Black Point on the South Coast, are mere fragments of the great Tertiary lava plains that occupied such a large part of the region of the South and Eastern Australia, the foundering of the western portion of which has left the few relics above sea level and on these erosion has not yet had time to be very active.

The volcanic eruptions probably began somewhere about the close of the Miocene Tertiary Period and terminated prior to the Pleistocene epoch. During the interval, which geologically is a relatively short one, there was time for the accumulation of these large flows. This remarkable collection of volcanic material has remained until the present time with its

original horizontality of bedding but slightly disturbed. Until these lava flows have been dissected by the weather, there is very little visible evidence of the masses of basic rocks, which almost certainly lie below the surface and constitute the magma from which the basalts emanate.

The Miocene beds of the Southern coast are intersected by dykes of dolerite, which may possibly be in some way connected with the basalts, thus affording a clue to the age of the volcanic activity.

The effects of this Tertiary vulcanism have been felt to a more or less marked degree in the goldfields areas in those portions of the State near the western shore line of the great Miocene Gulf, which extended far into the interior, and of which the Great Australian Bight, is but a relic.

The various scattered intrusive veins and dykes of dolerite, some of which contain olivine occurring in the Dundas Goldfield and elsewhere, in all probability belong to the same period of Tertiary igneous activity as the basaltic lavas. One of the dolerite dykes is seen traversing the gold-bearing quartz reef at the 145-feet level in the main underlay shaft of the Cumberland Gold Mine at Norseman. The newest igneous rock on the Dundas Goldfield is the remarkably fresh intrusive norite varying from a mile to half-a-mile wide, and which has been followed across country for a distance of at least 12 miles in an east and west direction. This dyke crosses the western shores of Lake Cowan, but has not yet been followed in that direction. A very suggestive feature in connection with this norite dyke is that its southern margin on the western side of Lake Cowan, has changed towards a peridotite.

In the country at the northern end of Lake Cowan there are olivine-dolerite dykes in a good state of preservation which may also represent smaller satellitic intrusions related to the Norseman norite which has been found to extend to the northern end of the Fraser's Range. Serpentines, the alteration products of peridotite, are of frequent occurrence in the country surrounding the Miocene sea; they contain veins and masses of dazzling white magnesite and opal's poor relation, chalcedonic silica, which result from attacks by water and carbonic acid of deep-seated origin.

The very great similarity in geological structure and constitution existing between the country bordering the Indian Ocean and Western Australia has repeatedly been stressed; it is therefore quite possible that the suggested connection between our southern basaltic lavas and the olivine-dolerite dykes and masses of serpentine bearing peridotites, find their chronological parallel in the ultra-basic relatives of those late Tertiary basaltic lavas which constitute such an important feature in Indian Geology.

The basic dykes and the basaltic lavas of the south-western portion of the State appear to belong to one series and reached their present position at about the same geological period. All the available evidence, therefore, points to the fact that they belong to the same geological era as the relatively recent volcanic rocks of South Australia and Victoria, viz., late Tertiary.

The Tertiary era has, as is well known, been one of pronounced activity over the south-western corner of the State, but no igneous rocks of this age have so far been recognised anywhere else in Western Australia, except in the Kimberley Division, near to that great circle of fire which forms a part of the festoon, round Northern Australia, traceable from the Himalayas, through the Malay Peninsula, the East Indies and New Guinea; the outer regions, lying to the southward of the northmost portion of the mainland of Australia, of which have been subjected to volcanic activity.

Basic lavas and ashes of Tertiary age occur in great force in Kimberley. These appear in the valleys of the Ord and Bow Rivers to have levelled up the depressions of the old land surface, except for certain knife-edged ridges of the older rocks, which still protrude above the general level. On the Behn River, just above what is known as the Gorge, a dome or "puy" basalt, which formed one of the foci from which the lavas issued, has been noted.

In the King Leopold Plateau, in the far north, the volcanic beds occur in great force, and form the highest part of the country. At Mount Hann, a very remarkable cliff-faced mountain, situated on the highest summit of the Plateau, dissected by the waters of the King Edward, the Drysdale, and the Prince Regent Rivers, the volcanic rocks are well exposed. The cliffs formed by the faces of the lavas and ashes rise perpendicularly from 100 to 300 feet in height. From the summit of Mount Hann the great extent of the volcanic rocks could be seen.

In the vicinity of Synnot Creek, on the King Leopold Plateau, is a remarkably coarse volcanic breccia covering a wide area, associated with lava flows. The coarse breccia or agglomerate occupies the throat of one of the volcanic vents which has not yet entirely disappeared by denudation; it is surrounded by lava flows and fine-grained volcanic ashes.

Leucite-bearing rocks have been met with in the Fitzroy Valley, where they occur in the form of volcanic necks, penetrating the carboniferous strata consisting of sandstones, shales, grits, conglomerate boulder beds and limestones, which have been gently folded, certain of the beds being arranged in a series of anticlinal folds of low amplitude whose main axes trend generally north-west and south-east. These volcanic necks are, in the middle basin of the Fitzroy River above Liveringa, sometimes associated with small local flows of leucite-bearing lavas. The easternmost occurrence of these alkaline rocks is at Christmas Creek in Lat. 19° South, and the most westerly near a hill about 13 miles north-west of Mount Wynne. They intrude rocks which have been affected to a slight extent by trough faulting. The necks and plugs have hardened and baked the shales, whilst according to the researches of Mr. Blatchford, the sandstones and grits have been vitrified to such an extent as to form a glass. These leucite-bearing rocks are particularly rich in potash. Petrographically these Kimberley leucite-bearing rocks very closely resemble those found in the islands of Borneo, Sumatra, and the Dutch East Indies. The leucite rocks which are found in several places near the north coast of the eastern portion of Java are believed to be of late Tertiary Age, agreeing in this respect with the Western Australian occurrences.

There is a hot spring issuing from the carboniferous sediments in the watershed of the Fitzroy, near Mount Wynne, in such a geological situation as connects it with the main tectonic lines of the district, and which would seem to point to the fact that this Tertiary igneous activity has not yet been entirely suppressed.

A long period of quiescence preceded the Tertiary period of intense volcanic activity, for no definite evidence of contemporaneous igneous rocks covering the time interval between the late Tertiary and the Permo-Carboniferous eras has been noticed in Western Australia.

Igneous rocks, provisionally assigned to the Ordovician (?Pre-Cambrian) period, occur in South Lat. 26° in the Townsend Range near the South Australian border. The formation is made up of ashes, marine quartzites, calcareous grit, and conglomerate associated with interbedded vesicular basaltic and dolerite lavas. It is interesting in this connection to note that igneous rocks of apparently the same age have been noted in South Australia.

Strata of undoubted Cambrian Age are known to occur in the Kimberley Division, where they extended over a very large area of country. During this age there ensued a period of volcanic activity resembling that of the Ordovician, though in increased volume, especially in the extreme easterly portion of the district, in S. Lat. 18°, near the South Australian border. The Great Antrim Plateau, which covers such a large area, is made up of bedded basic lavas of this geological age.

The most active centres of eruptive energy found anywhere in Western Australia occur in that group of rocks designated the Nullagine Formation, which is, perhaps, the most widely spread of any of the rock systems exposed in the State, as well as in some respects one of the most important.

The precise position which the formation occupies in the geological column is as yet one of the many unsolved stratigraphical problems in the State. None of the beds in the Nullagine Formation, despite the fact that the magnesian limestones are of marine origin, has as yet yielded any fossils, hence any correlation of the strata based upon palaeontological data can, in the light of our present day knowledge, be little else than tentative. The significance, however, of fossils in attempting to establish contemporaneity of formations, or the determination of geological age in relative terms, has, it is to be feared, often been unduly emphasised and somewhat incautiously employed. Organic factors are strongly influenced by, if not almost entirely dependent upon, physical conditions. Lithological peculiarities and the succession of associated rocks, together with the physiographical and diastrophic history, furnish criteria which have proved to be of exceptional value in geological correlation.

The Nullagine Formation has hitherto been assigned to the Pre-Cambrian Period, though it has been suggested that it may be Ordovician Age. Lithologically the strata consist of a great group of sedimentary rocks, sandstones, quartzites, conglomerate boulder beds and magnesian limestone, associated with which are numerous igneous rocks. Some of these were formed from congealed molten matter, crystallising as dolerite, which forced its way either along the planes of bedding or across the strata in the form of intrusive sheets, sills or dykes, whilst others were contemporaneous with the deposition of the associated sedimentaries and include outpourings of lavas, ashes and other volcanic ejectmenta. From numerous and widely separated centres of eruption of which the remains at present exist, lavas and ashes were thrown out, submerging fairly large areas of country. So far as researches in the field have been carried, the volcanic foci all seem to be situated along or on the northern portion of the area in proximity to what would appear to be the shore line of a gradually receding ocean. The very great extent of the lava flows and associated ejectamenta seem to imply that these centres of eruption must, during Nullagine time, have appeared as a remarkable chain of coastal volcanoes, but whether they are distributed along lines of orographic movement is one of those as yet unsolved problems of Western Australian geology.

The occurrence of sandstone, quartzite and other sediments interbedded with lava flows, etc., points to the fact that some of these volcanic eruptions took place under water and must have been followed by intervals during which sedimentation was carried on.

These volcanic beds occur in great force in the King Leopold Plateau in Kimberley, and form the highest parts of the country; whilst in certain localities they reach a considerable thickness, often over 500 feet.

As a rule these lavas have the mineralogical composition of basalts or dolerites, though in certain parts, such as Mount Anketell, West Pilbara, they are closely allied to augite-andesite; while at Bamboo, on one of the tributaries of the Coongan River, acidic lavas, quartz felsite, rhyolite, occur near the base of the formation. The steam holes in many of the amygdaloidal lavas are filled with secondary minerals, partly chalcedony and partly calcite.

The widespread occurrence of these lavas and their associates, together with the relatively few volcanic foci so far noticed, would seem to imply that fissure eruptions played an important part in the formation. This type of vulcanism finds a parallel in the 200,000 square miles occupied by the Cretaceous Deccan Trap areas of India and those extensive lava plains of Northern Queensland which I have been privileged to examine.

A very important feature in the region occupied by, and adjacent to, the Nullagine Formation is the abundance of dolerite intrusions. Those dolerites have a remarkably uniform composition, and wherever they have been examined they exhibit little or no trace of recrystallisation or other signs of metamorphism. Occasionally a glassy selvage, due to rapid cooling, may be noticed occurring at the contact between the dykes and the rocks they traverse.

The dolerites seem to be in practically the same condition in which they originally congealed, and no great terrestrial disturbance seems to have affected the region since the time of their injection.

The dyke rocks are all readily distinguished by their dark-greenish colour, a rusty and, in places, exfoliating weathering. Some extend across country in more or less straight lines for many miles and give rise to fairly conspicuous features standing out boldly on the back of the ridges. In some cases these dykes may be seen invading the sedimentary rocks along the planes of bedding; occasionally an effect of the igneous intrusion an arching up the overlying strata may be noticed. On the northern face of the plateau, in the watershed of the Maitland River in the West Pilbara Goldfield, there may be seen a splendid example of one of these dolerite dykes, cutting the horizontal strata transversely. These basic dykes may also be seen at other localities outside the limits occupied by the Nullagine Beds; they have been noticed in mine workings.

There is as yet little definite evidence as to the nature and composition of the parent magma, from which these igneous rocks were derived, nor any adequate explanation as to why the rocks are acidic in composition in some localities and basic in others. As regards the problem connected with the relative age of the lavas, ashes and the dykes, there is as yet but little direct evidence; it is, however, quite possible that they may be grouped together into one series, which may be held to represent one distinct place of the volcanic phenomena of the State during Nullagine time.

The Nullagine Formation rests with a very violent discordance upon the older Archaeozoic rocks, and is made up in very large part of material derived from the rocks of the ancient continental land surface, which was evidently exposed to prolonged denudation prior to the deposition of the Nullagine beds.

The geological formation of pre-Nullagine times is entirely confined to the most ancient epoch in the history of the earth's crust of which we have any visible and tangible record, and belong to a very remote and hoary past, furnishing as it does evidence of the processes of world-making and contains relics of the remote conditions when the crust yielded to the almost inconceivable earth force.

The rocks of pre-Nullagine times, constituting, as they do, the foundation stones of Western Australia, are of such a nature as point to prolonged igneous activity, and have shared in those intense terrestrial disturbances which must have been carried on over a very considerable lapse of geological time. It is under any circumstances a difficult task to decipher the records of the rocks in such a way as to interpret the sequence of events in the past volcanic history of any country. It is especially so in the case of such a vast and remarkable assemblage of igneous rocks and other differentiates and constitutes by far the largest mass of the Archaezoic formation. These have been so well described by Mr. de C. Clarke, in his Anniversary Address on the Pre-Cambrian System in Western Australia, delivered in July, 1923, that it is unnecessary on this occasion to retraverse the same ground, more especially as in the address, which I was privileged to submit to you at our Annual Meeting last year, a resumé of the igneous activity of this period and its economic aspects was presented.

It was, *inter alia*, pointed out that a dominant feature was the intrusion of batholiths of granite with their satellitic differentiates in such a gigantic scale as almost entirely to overshadow that of the earlier sedimentary and igneous formations, and that such represented the most important event in the Pre-Cambrian geological history of Western Australia.

The pegmatite veins contain some of the rare uranium-bearing minerals as their accessory constituents, which afford a means of determining their minimum geological age in terms of years, though such, until comparatively recently, proved a very formidable tax upon geologists' arithmetic. Calculations based upon the quantities of lead and radio-active elements occurring in the pegmatite dykes of Wodgina in the Pilbara Goldfield, give their age as 1,260 million years. These dykes invade a series of highly metamorphic sedimentary rocks associated with contemporaneous lavas and ashes; hence these beds which were in existence prior to the pegmatite intrusions must be of considerable antiquity, and they must at least be much older than the period of years just mentioned.

The problems of the source of molten magmas, the causes and mechanism of the manner of their ascent to the surface, the origin of the different types of magma and other aspects of the natural history of the igneous rocks, provide abundant opportunities for both collective and individual research and leave a very wide field open for investigation.

The rapid review of igneous activity in Western Australia has now been completed. During the course of this brief excursion amid the abysses of geological time a very passing glimpse has been given of the changes in the volcanic activity, which was rife during the different periods of Western Australia's geological history.

While we scan the surface of the State as it at present appears, its features seem instinctively to melt away into visions of what it once has been, and we then come to feel the force and realise something of the meaning of the exclamation in the Book of Job that, "Man putteth an end to the darkness, and exploreth to the utmost limit the stones of darkness."

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